# FINAL SUBMITTAL

ENERGY SURVEYS OF

ARMY INDUSTRIAL FACILITIES

ENERGY ENGINEERING ANALYSIS PROGRAM

RADFORD ARMY AMMUNITION PLANT

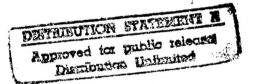
RADFORD, VIRGINIA

**VOLUME II** 

**APPENDICES** 

89

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PREPARED FOR:

U.S. ARMY CORPS OF ENGINEERS NORFOLK, VIRGINIA

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**MARCH 1991** 

# DEPARTMENT OF THE ARMY

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# APPENDIX A

# PRENEGOTIATION MINUTES NOTES RADFORD AAP INDUSTRIAL FACILITIES STUDY

Attendees: Graham Ellixson

Paul Hutchins

Date:

08/25/89

- o Entire project will require about 13 months.
- o Give formal presentation at each conference (2).
- o Graham will provide a list of submission copies requirements.
- Intent is to find energy savings in industrial processes, not buildings. Therefore, much of the data requested in the SOW for building envelop data [SOW 3.1.4] is superfluous and should have been gathered in the previous EEAP. Graham suggested that I use my judgement in these matters. Our philosophy concerning this is as follows: if the building is conditioned because of process-related requirements, then building envelop data are required. If the building is conditioned for personnel comfort only, then the envelop data are not required.
- o Remove EMCS from SOW.
- o Concentrate on smaller projects--stay away from ECIP.
- o Update three projects from previous EEAP.
- No solar.
- Will send Graham examples of linear regression analysis.
- o Rescheduling of production lines at Radford will be difficult.
- o Send map of Radford areas and building lists to Graham.
- o RAAP has requested that A/E <u>not</u> package projects for funding source and documentation. RAAP prefers to do this.

CENAO-EN-MP

July 1989

DETAIL/GENERAL SCOPE OF WORK

ENERGY SURVEYS OF ARMY INDUSTRIAL FACILITIES

ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP)

RADFORT ARMY AMMUNITION PLANT (RAAP)

RADFORD, VIRGINIA

# SCOPE OF WORK ENERGY SURVEYS OF ARMY INDUSTRIAL FACILITIES ENERGY ENGINEERING ANALYSIS PROGRAM

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- 1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (AE) shall:
- 1.1 Perform a complete energy audit and analysis of the industrial facility.
- 1.2 Identify all Energy Conservation Opportunities (ECOs) including low cost/no cost ECOs and perform complete evaluations of each.
- 1.3 Prepare programming and implementation documentation for all justifiable energy conservation opportunities.
  - 1.4 List and prioritize all recommended energy conservation opportunities.
- 1.5 Prepare a comprehensive report which will document the work accomptished, the results and the recommendations.

# 2. GENERAL:

- 2.1 A coordinated energy study, including a detailed energy survey, shall be accomplished for the industrial facility. The study shall integrate the results of and any available data from prior or ongoing energy conservation studies, projects, designs, or plans. This Scope of Work is not intended to prescribe the methods in which the study is to be conducted or limit the AE in the exercise of his professional engineering expertise, good judgment or investigative ingenuity. However, the information and analyses outlined herein are considered to be minimum essentials for adequate performance of this study. The study shall include a comprehensive energy report documenting study methods and results.
- 2.2 All ECOs recommended shall comply with all current criteria (e.g., environmental, safety) for the industrial facility. These criteria may have changed since the facility was constructed. Replacement of people with automation systems may allow reductions in outside air quantities, ventilation rates, and similar items resulting in significant energy savings. Stated requirements for special environments (temperature/humidity control) for industrial equipment and processes shall be researched as needed by the AE to verify (a) the requirement and (b) the degree of control essential for the industrial mission.
- 2.3 All recommended ECOs, including maintenance, operational and low cost/no cost opportunities as well as Energy Conservation Investment Program (ECIP) and Energy Conservation and Management Program (ECAM) projects shall be ranked in order of highest to lowest Savings Investment Ratio (SIR).
- 2.4 An Energy Engineering Analysis Program (EEAP) study has been accomplished for the installation. Applicable portions of the study, 4f any, shall be updated as needed and incorporated into the report. The report shall list

the recommended ECOs from the previous study that pertain or should pertain to industrial facilities processes. This list shall summarize the ECOs (cost, short description, and anticipated energy savings) and identify the fiscal year for which the project was or is programmed. Any industrial facility related ECO identified in the previous studies but not recommended shall be reevaluated under this contract. Any industrial facility related ECO recommended from the previous studies but not implemented nor programmed for implementation shall be updated in accordance with the latest ECIP criteria. Three (3) projects as per D-5.

- 2.5 The terms "industrial," "production," and "process" are used interchangeably in this Scope of Work and should be interpreted broadly to include research, test and development, end item maintenance and repair, supply and distribution, as well as the typical "production centers" in Army industrial facilities. The term "facility" means one or more buildings or enclosures together with the equipment installed therein. It implies an integrated production system which requires a coordinated approach to achieve the best overall results.
- 2.6 The "Energy Conservation Investment Program (ECIP) Guidance," described in letter from DAEN-MPO-U, 10 August 1982 and revised by letters from DAEN-ZCF-U, 4 March 1985 and 11 June 1986, establishes criteria for ECIP/ECAM Projects and shall be used for performing the economic analyses of all ECOs and projects. Construction cost escalation for DD Form 1391 submission shall be calculated using the guidelines contained in AR 415-17 and the latest Tri-Service MCP index. The Tri-Service MCP Index, when updated, is contained in the latest applicable edition of the Engineer Improvement Recommendation System (EIRS) bulletin.
- 2.7 Energy conservation opportunities determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar ECOs into larger packages which will qualify for ECIP/ECAM or MCA funding, and determining, in coordination with installation personnel, the appropriate packaging and implementation approach for all feasible ECOs.
- 2.8 Projects which qualify for ECIP/ECAM funding shall be identified, separately listed, and prioritized by Savings Investment Ratio (SIR).
- 2.9 All energy saving opportunities shall be listed and prioritized by SIR.

# 3. WORK TO BE ACCOMPLISHED:

3.1 Audit. The audit consists of gathering data and inspecting industrial facilities in the field, including those which are government-owned, contractor operated (GOCO). These activities shall be closely coordinated with the contractor operator at GOCOs, facilities or plant engineer representatives, production engineers, the installation commander or his representative, and the Government's representative. The AE shall become thoroughly familiar with the facility and its industrial mission and undertake all necessary field trips to

obtain required data. The AE shall consolidate or summarize the survey data to make it concise, and shall submit the summarized data as part of the report. Data sources shall be identified and assumptions clearly stated and justified. All test and/or measurement equipment shall be properly calibrated prior to its use.

- 3.1.1 Boiler plants, chilled water plants, incinerators, and similar facilities listed in Annex D that are associated with the industrial facility shall be included in the study. The intent is to determine the condition of existing equipment, efficiency of boiler plant equipment, operational procedures, adequacy of plant capacity, and heat recovery possibilities in addition to the general items listed.
- 1.1.2 During the audit process promising applications of solar-energy for industrial processes shall be identified. Tremendous amounts of steam and hot water are used in industrial facilities dictating active consideration and analysis of potential solar applications.
- 3.1.3 The audit shall be conducted with the view that the term "industrial facility" means an integrated production infrastructure including the building envelope, industrial equipment, process standards, materials, utilities and other components of the industrial operation which have an energy value.

Envelope energy and process energy are interrelated. Inputs and outputs, particularly of thermal energy, should be balanced in order to optimize overall energy efficiency of industrial facilities. ECOs should therefore reflect the "systems" approach for a totally integrated facility, and assure that any energy trade-offs between buildings and processes are analyzed.

- 3.1.4 Data collected during the audit shall, as a minimum, include:
- 3.1.4.1 Building data.
- a. Building number, building age, number of floors, and gross square feet.
- b. Floor area, HVAC zones, nonair-conditioned spaces, and usage of space ("industrial" or "other").
  - c. Glass areas.
- d. Wall and roof surface areas and condition, type of construction, and "U" factors.
- e. Drawings, equipment schedules, shop layouts, utilities distribution diagrams, etc.
  - f. Nameplate data of energy related building equipment.
  - g. Any major expansions, alterations, or modernization projects.

- 3.1.4.2 Weather information.
- 3.1.4.3 Operating methods.
- a. Pacilities operating hours (peacetime).
- b. Personnel strength (direct labor).
- c. Facilities system and equipment operating and maintenance schedules.
- d. 3.1.4.3.4 Control set points, chilled water temperatures, and freeze protection temperatures.
  - e. Rooms, areas, or zones with special or critical requirements.
  - . 3.1.4.4 Past performance records.
    - a. Energy peak demands.
- b. Latest annual energy consumption (Gross BTU/yr, BTU/SF/yr, BTU/and product/yr) for total installation and facility(ies) being studied.
  - c. Utility rate schedules.
- d. Energy conservation projects (ECIP/ECAM/other) in facilities being studied.
  - 3.1.4.5 Energy sources.
  - 3.1.4.6 Production data.
- a. Production areas by type utilization -(e.g., fabrication, finishing, assembly, test, storage, etc.).
- b. Production equipment schedules, age, utilization, and energy requirements.
  - c. Production equipment replacement or modernization plans.
  - d. Process flow layouts.
  - e. Production rates/quantities.
  - f. Material handling systems.
  - g. Expected changes (equipment, process, facilities, workload, etc.).
- 3.2 Analysis. The energy analysis is a comprehensive study of the industrial facilities energy usage. It includes a detailed investigation of the operation, environment and equipment. Computer modeling shall be used to in-

corporate field survey data, weather data, production data, operation schedules, building construction data, energy distribution systems and equipment data into a model of the total facility. The computer program shall, for varying production rates (peacetime levels and full mobilization), develop load profiles, calculate energy savings, and evaluate the energy requirements of the industrial facility, using a "Linear Regression" model program. The computer results should be verified by comparing them to any available past utility bills or records. The A-E shall submit a sample computer run with an explanation of all input and output data, and a summary of program methodology and energy evaluation capabilities for approval by the Contracting Officer prior to use of the program for analysis.

- 3.2.1 The energy analysis shall provide the following types of information:
- a. A baseline of energy usage of the existing facility (at current production capacity prior to implementing ECOs generated by this study).
  - b. Comparison of equipment capacities with current workloads.
- c. Process related energy usage by systems (lighting, heating, cooling, process, etc.).
  - d. Basis for evaluating ECOs.
- e. A baseline of energy usage of the facility after incorporation of all recommended ECOs (assuming no change in production level).
- 3.2.2 The AE shall develop graphic presentations, i.e. graphs and charts which depict a complete energy consumption picture for the industrial facility both presently and after implementation of energy saving recommendations.
- 3.2.3 The AE shall develop a listing of each shop, zone, or area of the facility as appropriate. The list shall include the air handling system and humidity setpoints, lighting levels and similar data. The valid criteria requirements for supply, return and exhaust air quantities, temperature and humidity setpoints, lighting levels, etc., shall also be shown. The listing shall be in sufficient detail so that areas with potential energy savings can be identified. The AE shall be familiar with the latest Army environmental and safety criteria and shall evaluate installed systems for possible energy saving revisions which may be permitted by current criteria.
- 3.2.4 If data is available, the AE shall develop an historical load profile by year for the past three fiscal years for each energy source utilized.
- 3.2.5 The AE shall project energy costs for three fiscal years from the date of contract award. Department of Energy (DOE) projections are acceptable.

3.3 Identify ECOs. All methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures and maintenance practices as well as the physical facilities. A list of energy conservation opportunities is included as Annex A to this scope. This list is not intended to limit or guide the AE but only to assure that at least these opportunities are considered. Each of the items shall be discussed in the report. Those items on the list which are not practical, have been previously accomplished, are inappropriate or can be eliminated from detailed analysis based on preliminary analysis shall be listed in the report along with the reason for elimination from further analysis. All potential ECOs which are not eliminated by preliminary considerations shall be thoroughly documented and evaluated as to technical and economic feasibility. The AE shall provide all data needed to support the recommended ECO. All assumptions shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. Life Cycle Cost Analysis Summary Sheet shall be prepared for each ECO and included as part of the supporting data.

# 3.4 Energy Monitoring and Control Systems (EMCS)/Process Control System (PCS).

3.4.1 The AE shall determine the feasibility of an EMCS/PCS for the industrial facility. The intent of this study is to determine the basic conceptual architecture of the EMCS/PCS to the extent that primary economic calculations can be made to determine feasibility per ECIP criteria. The documentation shall be of sufficient accuracy to insure that future project design calculations that will be done after completion of this study will not deviate more than 20 percent from the results of this study.

3.4.2 The AE shall survey all buildings and perform feasibility evaluations in accordance with guidance in HNDSP-84-076-ED-ME. Any existing basewide EMCS project or any currently under design or study shall be considered and evaluated for intergration. The use of existing survey data is acceptable only if it is in sufficient detail and can be easily revalidated by building walk through inspections. The standard evaluation forms contained in HNDSP-84-076-ED-ME shall be a part of the submittal. EMCS/PCS analyses and evaluations shall be developed using TM 5-815-2. Energy savings calculations shall be in accordance with NCEL CR 82.030. The AE shall consider connection of the industrial facility to this basewide system. An independent system for the industrial facility and some type of communication with the basewide system for monitoring and data gathering shall also be considered. EMCS/PCS evaluations shall consider but not be limited to the following features:

# a. Start/Stop Programs

Scheduling
Duty cycling
Load shedding for electrical demand limiting
Lighting control
Start/Stop Optimization

by Ventilation and Recirculation Programs

Dry bulb economizer
Outside air reduction
Industrial process economizer
Exhaust air reduction/optimization (based on production activity)

c. Temperature Reset Programs

Space temperature night setback
Process temperature night setback
Hot and cold deck
Reheat coil
Chilled water
Chiller selection
Boiler selection

- d. Labor Savings/Monitoring (Example: Boiler plant monitoring (EMCS/PCS logging of points which are present are manually logged.)
  - e. Machine run time, production profiles and maintenance management
- 3.4.3 The AE's recommendations for an EMGS/PCS shall be in sufficient detail to define the system configuration, the approximate quantity and types of control instruments and sensors, and the data transmission system. The selection of points to be monitored and controlled shall be given priority based upon ECIP criteria. The control system functions, expected energy reduction, and monetary savings (including the manner in which these savings are to be achieved) shall be explained.
- 3.4.4 The AE shall prepare and provide recommendations in narrative form. Input/output (I/O) summary tables shall be prepared and provided for each system selected in accordance with HNDSP-84-076-ED-ME. Cost estimates shall be prepared and provided in accordance with HNDSP-84-076-ED-ME for the mechanical and electrical modifications required to implement the EMCS/PCS.
- 3.4.5 Inoperative controls shall be surveyed in accordance with TM. 5-815-2. Cost estimates to repair and replace inoperative controls shall be as described in HNDSP-84-076-ED-ME.
- 3.4.6 Labor savings/monitoring shall be included, provided the SIR is not affected to the extent of jeopardizing the ECIP requirements.
- 3.5 Project Documentation. All energy conservation opportunities (ECOs) the AE has considered shall be included in one of the following categories and presented as such in the report:
- 3.5.1 ECIP/ECAM Projects. To qualify as an ECIP/ECAM project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than \$200,000 and Savings Investment Ratio greater than one and a

simple payback period of less than ten years. For ECAM projects, the \$200,000 limitation may not apply. The AE shall check with the installation for guidance. The overall project, and each discrete part of the project, shall have a SIR greater than one. For all projects meeting the above criteria, complete programming documentation will be required. Programming documentation shall consist of a DD Form 1391, Life Cycle Cost Analysis Summary Sheet(s) (with necessary backup data to verify the numbers presented), and a project development brochure (PDB). These forms shall be separate from the report. They shall be bound similarly to the final report in a manner which will facilitate repeated disassembly and reassembly. A Life Cycle Cost Analysis Summary Sheet shall be developed for each ECO and for the overall project when more than one ECO is combined. For projects and ECOs updated or developed from the previous studies, the backup data shall consist of copies of the original calculations and analysis, with new pages updating and revising the original calculations and analysis. In addition, the backup data shall include as much of the following as is available: the increment of work the project or ECO was developed under in the previous study, title(s) of the project(s), the energy to cost (E/C) ratio, the benefit to cost (B/C) ratio, the current working estimate (CWE), and the payback period. This information shall be included as part of the backup data. The purpose of this information is to provide a means to prevent duplication of projects in any future reports. For projects or ECOs the installation wants submitted as ECIP/ECAM projects, complete programming documentation shall be prepared.

ments shall be prepared in accordance with AR 415-15 and the supplemental requirements in Annex 8. A complete DD Form 1391 shall be prepared for each project. The form shall include a statement that the project results from an EEAP study. Documents shall be complete as required for submission to higher DA headquarters. These programming documents will require review and signatures by the proper installation officials. All documents shall be complete except for the required signatures.

- 3.5.1.2 Project Development Brochures (PDBs). Preparation of PDBs requires the AE to delineate the functional requirements of the project as related to the specific site. The AE shall prepare PDBs in accordance with AR 415-20 and TM 5-800-3. Most projects will not require all the forms and checklists included in the Technical Manual (TM). Only that information needed for the project shall be included. The PDB-I format described in the TM shall be used for whatever information is needed.
- 3.5.1.3 Supporting Data. The AE shall provide all data and calculations needed to support the recommended project. Descriptions of the products, manufacturers catalog cuts, pertinent drawings, and sketches shall also be included. A Life Cycle Cost Analysis Summary Sheet shall be prepared for each ECIP project and each discrete part of the project and included as part of the supporting data.
- 3.5.2 Non-ECIP/ECAM Projects. Projects which normally do not meet ECIP/ECAM criteria, but which have an overall SIR greater than one shall be

individually packaged and fully documented. The Life Cycle Cost Analysis Summary Sheet shall be completed through and including line 6 for all projects or ECOs. Each shall be analyzed to determine if they are feasible even if they do not meet ECIP/ECAM criteria. These ECOs or projects may not meet the nonenergy qualification test. For projects or ECOs which meet this criteria, the Life Cycle Cost Analysis Summary Sheet, completely filled out, with all the necessary backup data to verify the numbers presented, a complete description of the project and the simple payback period shall be included in the report. Additionally, these projects shall have the accessary documentation prepared, in accordance with the requirements of the Government's representative, for one of the following categories:

a. Quick Return on Investment Program (QRIP). This program is for projects which have a total cost not over \$100,000 and a simple payback period of two years or less.

- b. OSD Productivity Investment Funding (OSD PIF). This program is for projects which have a total cost greater than \$100,000 and a simple payback period of four years or less.
- c. Productivity Enhancing Sapital Investment Program (PECIP). This program is for projects which have a total cost of more than \$3,000 and a simple payback period of four years of less.

The above programs are described and documentation shall be prepared in accordance with AR 5-4, Change No. 1.

- d. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than \$200,000 and a simple payback period of ten to twenty-five years. Projects or ECOs which qualify for this program shall be economically analyzed in accordance with the requirements for Special Directed Studies in Engineering Technical Letter (ETL) 1110-3-332. Documentation shall be in accordance with paragraph 3.5.1 except that the economic analysis required by ETL 1110-3-332 shall be included in lieu of the ECIP Life Cycle Cost Analysis.
- e. Low Cost/No Cost Projects. These are projects that the installation can perform using their funds. For these projects the following information shall be provided:
  - (1) Brief description of the project.
  - (2) Brief description of the reasons for the modification.
  - (3) Specific instructions for performing the modification.
  - (4) Estimated dollar and energy savings per year.
- (5) Estimated manhours and labor and materials costs. Costs shall be calculated for the current calendar year and so marked. Manhours shall be

listed by trade. For projects that would repair an existing system so that it will function properly, also include the estimated manhours by trade and labor and material costs necessary to maintain the system in that condition. Some of the simple practical modifications may be developed on a per unit basis. An example of this type of modification would be the repair or replacement of steam traps on an as needed basis. As a rule, however, the AE should develop complete projects, if at all possible, rather than per unit modifications. Separate sheets for each project showing the above information shall be prepared and included in the report.

- 3.5.3 Nonfessible ECOs. All ECOs which the AE has considered but which are not fessible, shall be documented in the report with reasons and justifications showing why they were rejected.
- 4. <u>DETAILED SCOPE OF WORK</u>: The general Scope of Work is intended to apply to contract efforts for all Army industrial facilities except as modified by the detailed Scope of Work for each specific installation. The detailed Scope of Work is contained in Annex D.

# 5. PROJECT MANAGEMENT

- 5.1 Project managers. The AE shall designate a project manager to serve as a point of contact and liaison for all work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The AE's designated project manager must be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for coordination of work under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this contract. This individual will be the Government's representative. The Project Manager designated for the Norfolk District Corps of Engineers is Mr. Graham J. Ellixson, Ph. (804) 441-
- 5.2 Installation assistance. The Commanding Officer or contractor operator at each installation will designate an individual who will serve as the point of contact for obtaining information and assisting in establishing contacts with the proper individuals and organizations as necessary to accomplish the work required under this contract. That individual designated for RAAP is Ms. Joanne Wills.
- 5.3 <u>Public disclosures</u>. The AE shall make no public announcements or disclosures relative to information contained or developed under this contract, except as authorized by the Contracting Officer.
- 5.4 Meetings. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The AE and/or the designated representative(s) shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer.

5.5 Site visits, inspections, and investigations. The AE, consultants, if applicable, and/or designated representative(s) thereof shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

# 5.6 Records

- 5.6.1 The AE shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the AE and/or designated representatives(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The AE shall forward to the Contracting Officer within ten (10) calendar days, a reproducible copy of the records.
- 5.6.2 The AE shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The AE shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record or receipt.

# 6. SUBMITTALS, PRESENTATIONS AND REVIEWS

- 6.1 General. The work accomplished shall be fully documented by a comprehensive report. The report shall have a table of contents and be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. The AE shall give a formal presentation of all but the final submittal to installation, command, and other government personnel. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted on the same day following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. The AE shall provide all comments and written notification of the action taken on each comment to all reviewing agencies within three weeks after the review meeting. It is anticipated that each presentation and review conference will require approximately one working day. The presentation and review conferences will be at the installation on the date(s) agreeable to the AE and the Government's representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose. Conference schedules are as provided in the Detail Scope.
- 6.2 Interim submittal. An interim report shall be submitted for review after completion of the field survey and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and

contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings and SIRs of all the ECOs shall be included. The simple payback period of all ECOs shall be calculated and shown on the report. The AE shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. During the review period, the Government's representative and Facilities Energy Coordinator shall provide the A-E with direction for packaging or combining ECOs for programming purposes. A sample programming document (DD Form 1391), PDB and supporting data) for one ECIP/ECAP project shall be submitted with this submittal for review and approval prior to the preparation of the other programming documents. To the degree

- possible, the project selected for the sample submission shall be typical of the majority of subsequent projects to be submitted. This sample shall consist of complete project documentation with primary emphasis on format and manner of presentation rather than precise accuracy of cost estimates and energy saving data. The survey forms completed during the audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.
  - 6.3 Prefinal submittal. The AE shall prepare and submit the prefinal report when all of the work under this contract is complete. The AE shall submit the Scope of Work for the installation studied and any modifictions to the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. The report shall integrate all aspects of the study. The report shall include an order of priority by SIR in which the recommended ECOs should be accomplished. Completed programming and implementation documents for all recommended new and reevaluated projects shall be included. The programming and implementation documents shall be ready for review and signature by the installation commander. The prefinal report, Executive Summary, and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly and reassembly. The prefinal submittal shall be arranged to include (a) a separately bound Executive Summary, to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (see Annex C for minimum requirements), (b) the narrative report containing a copy of the Executive Summary at the beginning of the volume and describing in detail what was accomplished and the results of this study, (c) appendices to include the detailed calculations and all backup material and (d) the programming and implementation documentation. A list of all projects and ECOs developed during this study shall be included in the Executive Summary and shall include the following data from the Life Cycle Cost Analysis Summary Sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost. The simple payback period shall also be shown for these projects and ECOs.

- made during the review of the prefinal report or during the presentation shall be incorporated into the final report. These revisions or corrections may be in the form of replacement pages, which may be inserted in the prefinal report. or complete new volumes. Pen and ink changes or errata sheets will not be acceptable. If replacement pages are to be issued, it shall be clearly stated with the prefinal submittal that the submitted documents will be changed only to comply with the comments made during the prefinal conference and that the volumes issued at the time of the prefinal submittal should be retained. Failure to do so will require resubmission of the complete volumes. If new volumes are submitted, they shall be in standard three—ring binders and shall contain all the information presented in the prefinal report with any necessary changes made. Detailed instructions of what to do with the replacement pages should be securely attached to the replacement pages.
- 7. OPERATION AND MAINTENANCE INSTRUCTION. The AE shall prepare a one-day instructional course for the mechanical and electrical operation and maintenance personnel and affected production supervisors to explain possible energy saving potentials due to modified equipment and systems operation. The course will identify operational items noted during the audit, in both facilities and process areas, which will effect energy conservation, and will explain the saving possible. This course will be held near the end of the study period at a time! agreeable to the AE and the Government's representative. This course is in addition to the formal review and presentations required. An outline of the topics that will be covered shall be submitted with the prefinal report.
- 8. ENTRY AND EXIT INTERVIEWS. The AE and the Government's representative shall conduct entry and exit interviews with the Facilities or Plant Engineer and other interested managers before starting work at the facility and after completion of the field work. The Government's representative shall schedule the interviews at least one week in advance.
- 8.1 The entry interview shall thoroughly describe the intended procedures for the survey. As a minimum, the interview shall cover the following points:
  - a. Schedules.
  - b. Names of energy analysts who will be conducting the site survey.
  - c. Proposed working hours.
  - d. Support requirements from the facilities or plant engineer.
  - e. Limitations imposed by production operations.
  - f. Plant security and safety procedures.
- 8.2 The exit interview shall include a thorough briefing describing the work accomplished, problems encountered, probable areas of energy conservation, and any follow-on efforts which may be required.

9. SERVICES AND MATERIALS. All services, supplies, materials (except those specifically enumerated to be furnished by the Government), plant, labor, superintendence and travel necessary to perform the work and render the data required under this contract shall be included in the lump sum price of the contract.

#### ANNEX A

# ENERGY CONSERVATION OPPORTUNITIES (ECOs)

ECOs shall not be recommended if their implementation would be detrimental to the facility's mission during peacetime. ECOs which may pose a constraint on mobilization production requirements shall include an analysis thereof, along with recommended contingency actions. Industrial process ECOs shall include, but not be limited to, the following:

- a. Production equipment replacements, modifications, disposals.
- b. Energy efficient motors and variable frequency drives.
- c. Scheduling/loading of production equipment.
- d. Waste heat recovery from industrial processes.
- e. Automated control of production equipment integrated with existing or proposed EMCS equipment, if appropriate.
  - f. Improve facility layout and space utilization.
  - g. Solar applications.
  - h. Consolidate processes and equipment requiring special environments.
  - i. Building ventilation, exhaust systems.
  - 1. Production equipment maintenance.
- k. Improved methods/controls to reduce scrap, rework, and "goldplating," which consume energy without contributing to production mission.
  - 1. Steam distribution and condensate return systems.
  - m. Compressed air distribution systems, equipment and controls.
  - Lighting control (zones, levels, etc.). (Efficient types)
  - o. Electrical Distribution.
  - p. Radiant heating.
  - q. Loading dock seals.
  - r. Thermal storage.

# CONTINUATION OF ANNEX A

# ENERGY CONSERVATION OPPORTUNITIES (ECOs)

- Boiler flue gas recirculation
- Ventilation versus air conditioning
- -Insulation
- Reduction of glass area
- Improve efficiency of compressed air systems
- Cargo door strip curtains for controlled humidity warehouses
- Energy efficient ballasts

# ANNEX B

# REQUIRED DD FORM 1391 DATA

To facilitate ECIP/ECAM project approval, the following supplemental dara shall be provided:

- a. In title block, clearly identify project as "ECIP" or ECAM
- b. Complete description of each item of work to be accomplished including quantity, square footage, etc.
- c. A comprehensive list of building zones, or areas including building numbers, square foot floor area and usage (administration, production, etc.).
- d. Complete list of production equipment, process controls and ancillary equipment to be installed or retrofitted.
- e. List references, assumptions and provide calculations to support life cycle dollar and energy savings and indicate any added costs.
- (1) If a specific building, zone or area is used for sample calculations identify the building, zone or area, category, age, square footage floor area, window and wall area for such. For a specific piece of production equipment or system provide complete description, environmental requirement, manner of operation, age, etc.
  - (2) Identify weather data source, if applicable.
- (3) Compare process-building systems interface before and after improvements.
- (4) Provide and justify process criteria and temperature profiles before and after retrofit of buildings or modification of process. Include source of expertise and demonstrate savings claimed by process energy contributions, exhaust or outside air quantities, temperatures, humidity, production flow, etc.
- f. Recommended process/equipment efficiency improvements must identify data to support present properly adjusted operation and future expected efficiency. If full replacement of equipment is indicated, explain rejection of alternatives such as repair, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit/replacement.

- g. An ECIP/ECAM Life Cycle Cost Analysis Summary Sheet as shown in the ECIP guidance will be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were determined shall be included.
- h. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement attesting that all buildings and production equipment will be in active use throughout the amortization period.
- i. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.
- j. For each temporary building included in a project, separate documentation is required showing (1) a minimum 10-year continuing need, based on the installation's annual real property utilization survey, for active building retention after retrofit, (2) the specific retrofit action applicable, and (3) an economic analysis supporting the specific retrofit.
- k. Nonappropriated funded facilities will not be included in the ECIP project without an accompanying statement certifying that utility costs are not reimbursable.
- 1. Any requirements required by ECIP guidance dated 10 August 1982, and any revisions thereto. Note that unescalated costs/savings are so be used in the economic analyses.
- The five digit category code number for all ECIP/ECAM projects developed under this scope of work is 80000.

#### ANNEX C

# EXECUTIVE SUMMARY GUIDELINE

- 1. Introduction.
- 2. Building Data.
- 3. Present Energy Consumption.
  - o Total Annual Energy Used.
  - o Source Energy Consumption.

Electricity - KWH, Dollars, BTU
Fuel Oil - GALS, Dollars, BTU
Natural Gas - THERMS, Dollars, BTU
Propane - GALS, Dollars, BTU
Other - QTY, Dollars, BTU

- o Energy Consumption by Systems.
- 4. Historical Energy Consumption.
- 5. Production Profile and Trends.
- 6. Energy Conservation Analysis.
  - o ECOs Investigated.
  - o ECOs Recommended.
  - o ECOs Rejected. (Provide economics or reasons)
  - o ECIP/ECAM Projects Developed. (Provide list)\*
  - o Non-ECIP/ECAM Projects Developed. (Provide list)\*
  - o Operational or Policy Change Recommendations.
- \* Include the following data from the Life Cycle Cost Analysis Summary Sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR and the analysis date. For all programmed projects also include the year in which it is programmed and the programmed year cost. Show the simple payback period for all ECOs.

- 7. Energy and Cost Savings.
  - o Total Potential Energy and Cost Savings.
  - o Percentage of Energy Conserved.
  - o Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented Based on Projected Workloads.
- 8. Energy Plan.
  - o Project Breakouts with Total Cost and SIR.
  - o Schedule of Energy Conservation Project Implementation

# ANNEX D

# DETAIL SCOPE OF WORK

# ENERGY SURVEYS OF ARMY INDUSTRIAL FACILITIES

# ENERGY ENGINEERING ANALYSIS PROGRAM

# TABLE OF CONTENTS

Areas/Buildings to be Audited	D-2,3
Specific ECO <sup>5</sup>	D-4
Update of Previous Studies	D-5,6
Schedule of Activities	D-7
Submittal Distribution List	D-8,9
Government Furnished Criteria	D-9,10
Special Requirements and Information	D-11

# AREAS/BUILDINGS TO BE AUDITED

Due to the large number of buildings and diversity of building types it is impractical to list each individual building number. The intent is to survey buildings that contain the more energy intensive processes. It has been determined through discussions with RAAP personnel and review of existing energy data that the following production areas are the large energy users. Where there are multiple buildings of the same type, a single representative building will be surveyed.

AREAS	BLDG. NOS.	OF BLDGS.
Nitrogylcerin #2	9400's	57
Nitrocellulose		
В	2000's (28)	
C	3000's (39), 4026	68
Waste Acid A & B	420 's	9
Cast Propellent	4912-1 thru 4912-27 (62) 4912-36, 4913 (4), 4915 (5)	
	4919 (2), 4921 (4),	
	4924-1-7 (9), 4928, 4952	86
Pilot "B"	4912-28 thru 4912-54 (52), 4925, 8902, 8903, 9126	56
Pilot "A"	5008's (4)	4
Ignitor Line	5010, 5011, 5012, 5016, 5027	5
Solvent Propellent		
Green Lines		
В	2500's (40),	
C	3500's (48), 3670-3693 (34)	122
Inert Gas Plant	421, 4903	2
Solvent Recovery		
В	1609-1617 (36), 1659-1667 (27),	
	1728-1730 (12)	75
C	1618-1626 (36), 1668-1676 (27),	73
	4910's (9), 1731-1733 (15), 4911's (9)	94
Finish Areas		
В	1757-1762 (6)	6
Ç	1763-1765 (3), 3655-3658 (4),	•
	3675-3678 (8)	15
Common Finish Area	1825-1888 (36), 4934's (2)	38

D-2

AREAS	BLDG. NOS.	OF BLDGS.
Wastewater Treatment	4325, 7226, 424, 470's (3), 9126 5502	8
Incinerators	425, 429, 440, 441, 450	5
Acid	700's	32
Solventless Propellent		73
Premix 1	7102's (7), 7103's (8) 3647-3650 (4), 4904, 4905, 4932	22
RP1	7104-7112 (31), 7121 (2), 7124-7160 (11), 7221 (3), 3712-3751 (18)	65
Grain Finish	7800-7803 (5)	5
P-Line	7113	. 1
RP4	9300's (42)	42
Supplying these product	ion lines with energy are the followin	g:
Boiler/Power Houses	400, 4329	2
Compressed Air	700, 4705-01, 4333	3
Pump Houses	407, 408, 409, 404, 455, 4330	5

# SPECIFIC ECOS

- 1. Incinerators Building 440 and 441, oil fired, study alternative fuels.
- 2. Boilers and Chillers Other boilers in addition to Buildings 400 and 4329 and small chillers as located in Buildings in the study.

# SUMMARY OF ENERGY CONSERVATION OPPORTUNITIES (IN DESCENDING E/C PRIORITY)

Attlen	Valve afficially installed	Dropped because of existing steam trap maintenance program	Submitted Increment G. EC/CC = 4.95	Submitted Increment A	Submitted Increment A	Timers sheady installed	Submitted Increment A	Condensate system already Installed	Submitted - Inc. cment A	Not aubmitted because B/C < 1	Submitted - Increment B	Submitted Increment G. EC/CG = 1.17	Submitted - Increment B (Design Completed under WE project) .
in the	^	āĪ	Sul	Sul	Sul	į	Sub	E C	Sub	Ž	Sub	Suba EC/C	Subn
Payback Period, Years	1.2	3.2	3.6	6.3	6.7	9		9.6	7.8	= =	5.11	15.4	7.7
Bullar 8 Saved,	11.761	7.411	52,57 <b>8</b>	19,816	15.284	5,134	36.000	33, 142	306,448	18,146	328,520	1.185	1.098.614
Energy Saved, MBTU/Yr	3.224	1.695	13.295	25,808	3,352	366	3.838	8,240	60.349	16,225	311.91	£	
B/C Retlo	ı	1	4.7	1.1	3.0	,	4.2	<b>L</b> ,	9.	92.	Ξ	3	7.2
E/C Ratio	230.0	10.6	69.4	=	32.6	31.6	28.4	25.5	25.3	23.5	1.12	21.0	20.3
CWE In 1964 Dollara	14.021	23,955	191,537	536,089	102,895	31,454	135,200	323,384	2, 365, 729	690,755	3,786,679	18, 254	6.881,510
Project Description	Install Gate Valve in 8" Main at TNT Area	Replace Defective Steam Trape	Replacement and Installation of Gate Valves	Ambient Sensing Steam Centrol Valves	Individual Bay Heaters for FAD Houses	Final Wringer Timers	Change House Modifications	Relurn Condensale System for TNT Area	liest Pipe for FAD Houses	Heat Recovery For Air Dry House	Return Condensate System Plant-Wide	Replace Plastic Blow-out Panels with Insulated Panels, Mix House	Steam Tie-Line Linking Power House 400 with Horseshoe Area
Profect No.		:	1: 102-G	T - 105	T-101	;	T-108	:	T-104	;	T-106	MO-111G	T. 107

•											
Action	Submitted Increment A	Submitted - Increment A	Already in progress under WE progress.	Submitted Increment G, EC/CC = 0.14	E/C not valid; violates safety regulations	Submitted Increment G, EC/CC = 0.83	E/C not valid; violates safety regulations.	E/C not valid; violates safety regulations.	Submitted Increment (i, B/C = 0.40	E/G not valid.	Submitted Increment G. EC/CC = .91
Payback Period, Years	6.3	10.5	17.2	24.4	21.2	0.	24.7	25.2	6.0	<b>₹</b> .22	1.71
Dollars Saved,	23,337	58.723	16,300	956	1.916	1.34	1.63.1	1, 398	122.810	116,870	27,954
Energy Saved, Mistal/Yr	7,346	10,849	4,410	309	919	<b>26</b>	•	376	1.973	21.487	161.2
B/C.	3	1.1			1	9.	1	ı	6.21		~
E/C Ratio	•	17.6	15.1	13.3	12.3	11.5	6.01	10.7	•	9:	7.9
CWE to 1984	387.756	415,143	827.675	23,300	42.095	0.032	40,337	15,219	210, 102	2,481,000	154.491
Project Description	Insulating and Weather- prouting Combined Slups, Solventiess Press House, and 4th Rolled Powder Line	Heat Recovery for Curing Houses	Westhorise Change Ikuses	Insulate Wall & Roof, Ether Sill House	Insulate Wall & Roof Cotton Pulp & Dry House	Installation of Photocell at 4th Rolled Powder for Walkway Lighting	Insulate Wall & Rouf Press & Cutting House	Invitate Wall & Rivel. Mix thuse	Water Dry Tank Covers	Replace Drive Shafin with Individual Mixers at Poacher Blander Houses	Installation of HPS Lighting in Combined Shops, Boiling Tub Basement and Wringer Houses
Project No.	. 100	6 .		9811-0M	:	WO-112G			WO 114G		100
	Project Description Dullars Ratio Ratio METU/Yr. \$/Year Years	in 1964 E/C B/C Saved, Dullars Payback fin 1964 E/C B/C Saved, Saved, Pertud, Dullars Ratto Mittaling and Weather 187.756 16.9 1.1 7,346 23,737 16.3 Submitted Flower, and 4th Rolled Powder Line	Project Description  Insulating and Weather- providing Combined Shape, Solventiess Press House, and 4th Rolled Powder Line  Heat Recovery for Curing Houses  Curing Houses	Figlest Description  Project Description  In 1984 E/C B/C Saved, Saved, Perlud, Dullars Prosed in 1984 E/C B/C Saved, Saved, Perlud, Dullars Prosed in 1984 E/C B/C Saved, Saved, Perlud, Perlud, Dullars Prosed in 187.756 10.9 1.1 7.346 23.737 16.3 Shipps, Solventiess Prosed in 187.756 10.9 1.1 7.346 23.737 16.3 Shipps, Solventiess Prosed in 18.1 17.6 1.7 10.849 58.723 10.5 Curing Houses  Weathorise Change Houses 279.728 15.8 - 4,410 16.308 17.2	ti No. Project Description to 1964 E/C B/C Saved, Saved, Pertual, Dollars Project Description to 1964 E/C B/C Saved, Saved, Pertual, Pertual, Dollars Press Transfing and Weather— 187.756 16.9 1.1 7.346 23.737 16.3 Shups, Solventies Press House, and 4th Rolled Powder Line  Heat Recovery for Curing Houses  Weatherise Change Houses  Weatherise Change House  Mail thouse  Mail thouse  Mail thouse  Mail thouse  Mail thouse  Mail thouse  Mail thouse	Project Description   Poliste   E/C   B/C   Saved, Saved, Saved, Saved, Builare   Period, Builare	Project Description   Published   Publis	Project Description   Dollare   Ratio   Batto   Saved   Saved   Pertual	Froject Description   CWE   EVC   BAC   Saved   Saved   Saved   Period	Project Description   In 1944   E/C   BACC   Saved, Saved, Saved, Period, Period, In 1944   E/C   Saved, Saved, Saved, Saved, Saved, Period, Period, Providing Combined Press	Project   Description   Desc

# SCHEDULE OF ACTIVITIES

Activity	Calendar	Days	(NTP	Plus
NTP		0		
Interim Submittal		205		
Interim Review Conference		250		
Prefinal Submittal		295		
Prefinal Review Conference		335		
Prefinal (Corrected)/Final Submittal		365		

# SCHEDULE OF ACTIVITIES

Activity	Calendar Days	
NTP 10/23/89	0	
Interim Submittal	205	123. 25.5
Interim Review Conference	250	5 5
Prefinal Submittal	295	4.20.
Prefinal Review Conference	335	15.4%
Prefinal (Corrected)/Final Submittal	365	<u>سرخ .:</u>

# SUBMITTAL DISTRIBUTION LIST

ADDRESS	INTER IM (60%)	PREFINAL (90%)	FINAL (100%)	
Commander U. S. Army Engineer Division, North Atlantic				
ATTN: CENAD-EN-MM 90 Church Street New York, NY 10007	2 cys	2 cys	1 c <b>y</b>	
Commander Office of Chief of Engineers ATTN: CEEC-EE (McCarty) Pulaski Building Washington, DC 20314	Executive S	ummary only l cy	l cy	
Commander U. S. Army Engineer District, Norfolk		2 3,	,	
ATTN: CENAO-EN-MP (Ellixson) 303 Front Street Norfolk, Virginia 23510	3 cys	3 cys	2 cys	
Army Energy Office ATTN: DALO-LEP (Keath) New Cumberland Army Depot New Cumberland, PA 17070	Executive S	ummary only		
Commander USAMC Installations & Services Activity ATTN: AMXEN_B (G. Badtram) Building 60, 2nd Floor Rock Island, IL 61299-7190	1 c <b>y</b>	l cy	l cy	
Commander U. S. Army Ammunitions PDN Base Modernization Agency, Picatinny Arsenal ATTN: AMSMC-PBE(D) (Yose Yamoza) Building 171 Annex Dover, NJ 07801	2 c <b>ys</b>	2 c <b>ys</b>	l cy	
Commander Radford Army Ammunition Plant ATTN: SMCRA-OR (J. Wills) Radford, VA 24141-0298	<u>2 cys</u>	<u>2 cys</u>	<u>1 cy</u>	
Totals	10 cys	12 cys	8 cys	

#### GOVERNMENT FURNISHED CRITERIA

- (1) Building information schedule (manual).
- (2) Production equipment schedule.
- (3) Utility procurement records (including reimbursable).
- (4) Facilities engineering technical data support.
- (5) Equipment modernization/acquisition plan.
- (6) Basic utility systems information maps.
- (7) Equipment layout and utilization records.
- (8) Final reports of previously completed studies performed under the Energy Engineering Analysis Program (EEAP). Only portions pertaining to the industrial facilities, if any, need to be made available (attached, See D-5, D-6).
- (9) Latest copies of any other energy studies performed since the previous EEAP study. Only portions pertaining to the industrial facilities, if any, need to be made available.
  - (10) Installation Energy Plan.
  - (11) Army Facilities Energy Plan.
- (12) ETLs 1110-3-282, Energy Conservation; 1110-3-318, Procedures for Programming Energy Monitoring and Control Systems (EMCS) Funded through the MCA Program; and 1110-3-332, Economic Studies.
  - (13) Energy Conservation Investment Program (ECIP) Guidance, dated 10 August 1982, and revisions dated 4 March 1985 and 11 June 1986.
- (14) Information on Existing EMCS Studies, Designs, Construction Contracts, or Operating Systems.
- (15) TM 5-785, Engineering Weather Data; TM 5-800-2, General Criteria Preparation of Cost Estimates; TM 5-800-3, Project Development Brochure; and TM-5-815-2, Energy Monitoring and Control Systems (EMCS). (TM-5-815-2 used only be furnished if items 14, 17, and 18 are furnished.)

- (16) AR 415-15. Military Construction Army (MCA) Program
  Development; AR 415-17, Cost Estimating for Military Programming; AR 415-20,
  Construction, Project Development and Design Approval; AR 415-28, Department
  of the Army Facility Classes and Construction Categories; AR 415-35,
  Construction, Minor Construction; AR 420-10, General Provisions, Organization,
  functions, and Personnel; AR 11-27, Army Energy Program; and AR 5-4, change
  No. 1, Department of the Army Productivity Improvement Program.
- (17) INDSP-84-076-ED-ME, Preliminary Survey and Feasibility Studyfor Energy Monitoring and Control Systems.
  - (18) NCEL CR 82.030, Standardized EMCS Energy Savings Calculations.
- (19) The latest applicable Engineer Improvement Recommendation System (EIRS) Bulletin.
- (20) An example of a correctly completed programming document for an ECIP/ECAM Project.
  - (21) Production data.
- (22) Architectural and Engineering Instructions, DAEN-ECE-A, dated 13 March 1987.

#### SPECIAL REQUIREMENTS AND INFORMATION

1. Point of contact at Radford AAP and Liaison for all work required under this contract is:

Joanne Wills
Radford Army Ammunition Plant
ATTN: SMCRA-OR
Radford, Virginia 24141-0298
Phone: AV 931-7480, (804) 639-7480

- 2. The Fiscal Year to which all ECIP projects should be estimated to and programming or implementation documents prepared for is FY 92. Depending on project packaging, the Installation Commander may determine different program years for the final report. Remaining projects shall be escalated to a FY TBD.
- 3. A computer program titled Life Cycle Costing in Design (LCCID) is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. The computer program can be used for performing the economic calculations for ECIP and non-ECIP ECO's. The A-E is encouraged to obtain this computer program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, Illinois 61801. The telephone number is (217) 333-3977. A-E shall indicate in writing what program will be used.
- 4. Consolidated review comments will be provided to A-E by Project Manager about 14 days prior to review conferences. A-E will review each comment and provide consolidated proposed reponses to Project Manager 48 hours prior to conference.
- 5. A-E will provide cover letter with all submittals noting a review is required and that a Review Conference is scheduled approximately 45 days hence. Letter will also inform recipients of letter to follow from Norfolk District C.O.E. setting exact conference date.

# APPENDIX B BACKUP DATA AND CALCULATIONS

#### TABLE OF CONTENTS

- 1. Energy Prices and Economic Parameters
- 2. Effects of Steam Savings on Powerhouse #1 Coal Use and Power Production
- 3. Hourly Electrical Demand Data
- 4. Energy Distribution Analysis Back Up
- 5. Selected Production Data
- 6. Preliminary Evaluation of ECOs
- 7. ECO Calculations
  - Cover water dry tank surface with insulating spheres FN-U-1 FN-U-2 Insulate fiberglass water dry tanks GP-B-1 Install energy-efficient motors Install energy-efficient motors--upon failure GP-B-2 Install energy-efficient motors instead of rewind GP-B-3 GP-B-4 Install variable frequency drives on plant water pumps Replace existing IGG with heat recovery type GP-D-1 GP-D-2 Install Condensing Heat Exchanger at Power House #1 Replace incandescents with 35 W HPS screw-ins GP-N-1 GP-N-2 Replace incandescents with Circline fluorescents Replace exterior incandescents with fluorescents GP-N-3 Replace 40 W fluorescents with 34 W GP-N-4 Replace lamps and ballasts with energy-efficient types GP-N-5 GP-N-6 Replace incandescents with HPS fixtures GP-N-7 Replace inefficient ballasts Replace incandescents with color-corrected HPS screw-ins GP-N-8 Replace 40 W fluorescents with 34 W upon failure GP-N-9 GP-N-10 Replace inefficient ballasts upon failure Install vinyl strip door curtains GP-W-1 Reduce exhaust gas temperature in incinerator GP-X-1 Reduce water flow into incinerator GP-X-2 Reduce incinerator excess air GP-X-3 GP-X-4 Install turning vanes in boiler ductwork Install thermostatic control system in motor houses GP-X-5 GP-X-6 Change incinerator fuel to natural gas MF-X-1 Install preheat controls in FADs NC-U-1 Insulate boiling and poacher tubs NC-X-1 Modify boiling tub heating method Remove steam coils in Activated Carbon Area SR-I-1
- 8. Low Cost/No Cost ECO Calculations
- 9. Programming Documents Backup

#### Energy Prices and Economic Parameters

#### Energy Prices:

Purchased Electricity, 3,413 Btu/Kwh, \$8.87/MBtu, \$0.03026/kwh (average cost)

Energy charge: \$4.93/MBtu, \$0.0168/kwh Demand Charge: \$7.12/KW/Month

Source: Rate schedule and Radford AAP estimate

Fuel Oil #2, 138,690 Btu/Gallon, \$4.27/MBtu

Source: November 2, 1989 invoice

Natural Gas, 1.031 MBtu/Kcf, \$3.36/MBtu

Source: October 1989 Natural Gas Billing

Coal (Bituminous), 24.58 MBtu/Ton, PH#1 - \$1.61/MBtu, PH#2 - \$1.78/MBtu

Source: Radford AAP CY 1990 average delivered coal costs

#### Energy Savings/Costs:

Coal Savings: 1.32 MBtu coal/MBtu 40 psig steam

1.21 MBtu coal/MBtu 275 psig steam

Electricity Purchase vs. Generation Price

Differential Cost: \$1.11/MBtu 40 psig steam

\$0.35/MBtu 275 psig steam

#### Basis For Cost Estimates:

<u>Adjustment</u>	Labor	<u>Material</u>	Comments
Location	0.683	1.002	Only for estimates by Means, based on Roanoke, VA values
Sales Tax	N.A.	4.5 %	Includes state and local
FICA/Insurance	20.0%	N.A.	_
Overhead	15	.0 %	-
Profit	10	.0 %	-
Performance Bond	1	.0 %	-
Contingency	5	.0 %	New construction
	7	.5 %	Modernization
	10	.0 %	Renovation work
Hercules Support	6	.0 %	-
SIOH	5	.5 %	-
Design Fees	6	.0 %	-

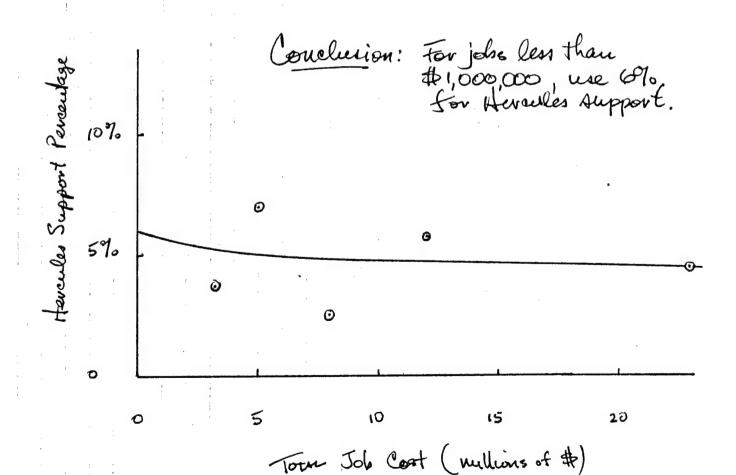
All costs are adjusted to January 1990.

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BUBJECT Hercules Support	AEP NO
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## Hercules Support Services

Total job	Lencules Support
\$ 23,000,000	3.5 %
\$ 8,000,000	2.6 %
\$ 5,000,000	7.0 %
\$ 12,000,000	5.8 %
\$ 3,200,000	3.8 %



#### EFFECTS OF STEAM SAVINGS ON POWERHOUSE #1 COAL USE AND POWER PRODUCTION

It is known that when process steam flow is reduced at the point of use in the production areas, there are two effects on energy purchases at Powerhouse #1. First, coal use is decreased and second, less electricity is generated due to the decrease in steam flow. Therefore, less coal is purchased and more utility-generated electricity is purchased. The following are the detailed calculations used to determine the change in coal use and electricity production at Powerhouse #1 when steam use is reduced due to implementation of an energy saving project.

The approach taken was to perform heat balances for three cases:

Base Case: Typical operating conditions

Case 1: 10,000 #/hr reduction in 40 psig process steam

Case 2: 10,000 #/hr reduction in 275 psig process steam

All pressures, temperatures and enthalpies were provided by RAAP except the final exhaust enthalpy. The final exhaust enthalpy was calculated using the turbine/generator performance chart and determining power production with no extractions. Coal use and electricity production were calculated for each case using fundamental engineering principles. The differences between the Base Case and Case 1 and the Base Case and Case 2 provided the steam-to-coal conversion factors and electricity price differential costs which are summarized at the beginning of this section.

#### STEAM-TO-COAL CONVERSION FACTOR

#### AND ELECTRICITY PRICE DIFFERENTIAL COST EXAMPLES

#### Example #1

Calculate savings due to 1 MBtu reduction in 40 psig steam use.

#### Example #2

Calculate savings due to 1 MBtu reduction in 275 psig steam use.

#### Example #3

Value of Steam at Powerhouse #1:

Coal savings - electricity price differential costs

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CURVE NO. BOUTOUL

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PERFORMANCE MAP POWER VS. STEAM FLOW INC. RADFORD ARMY AMMUNITION PLAN EB & BBO4001EB / G.O. A SLE EXTRACTION TURBIN ) F / 275. PSIG / 40. PSIG	T88-0003
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PERFORMANCE MAP POWER VS. STEAM FLOW INC. RADFORD ARMY AMMUNITION PLAN EB & BBO4001EB / G.O. A SLE EXTRACTION TURBIN ) F / 275. PSIG / 40. PSIG	T88-0003
PERFORMANCE MAP POWER VS. STEAM FLOW INC. RADFORD ARMY AMMUNITION PLAN EB & BBO4001EB / G.O. A SLE EXTRACTION TURBIN ) F / 275. PSIG / 40. PSIG	T88-0003
PERFORMANCE MAP POWER VS. STEAM FLOW INC. RADFORD ARMY AMMUNITION PLAN EB & BBO4001EB / G.O. A SLE EXTRACTION TURBIN ) F / 275. PSIG / 40. PSIG	T88-0003
PERFORMANCE MAP POWER VS. STEAM FLOW INC. RADFORD ARMY AMMUNITION PLAN EB & BBO4001EB / G.O. A SLE EXTRACTION TURBIN ) F / 275. PSIG / 40. PSIG	T88-0003
PERFORMANCE MAP POWER VS. STEAM FLOW INC. RADFORD ARMY AMMUNITION PLAN EB & BBO4001EB / G.O. A SLE EXTRACTION TURBIN ) F / 275. PSIG / 40. PSIG	T88-0003
PERFORMANCE MAP POWER VS. STEAM FLOW INC. RADFORD ARMY AMMUNITION PLAN EB & BBO4001EB / G.O. A SLE EXTRACTION TURBIN ) F / 275. PSIG / 40. PSIG	T88-0003

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## Heat Balance Calculations

Temperatures and pressures provided by RAAP

Throttle: 400 priz 750°F 1389 Btu/16
125 Ext: 275 priz 684°F 1360 Btu/16
242 Ext: 40 priz 440°F 1254 Btu/16
Exhaust: 2"Hz calculated below

Typical operating conditions allow minimum flow to the condensing section; From the terbine/ generator curves to this would be 20,000 #/hr.

Calculate exhaust enthalpy

For 20,000 # / hr Hhrottle and no extractions, the power generated is 1500 kW (from the the Turbine/Generator Performance Graph):
Therefore, assuming a 95% generator efficiency:

20,000 (1389 - h) \* 0.95 = 1500

20,000 \* 1389-20,000 h

= 1500 \* 3413 0.95

 $h = \frac{1500 \times 3413 + 20,000 \times 1389}{0.95}$ 

h = 1120 Btu/16

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I sentropie expansion (100% officiency) from throthe to achainst yields an enthalpy of 927 Btu/16. From this efficiencies can be calculated for the various flow rates.

$$Eff = \frac{1389 - h}{1389 - 927} = \frac{1389 - h}{462}$$

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Calculate effects of saving steam at point of lead.

Assumptions: (provided by Hercules personnel)

- Boiler efficiency = 0.85
- Flow to condenser is 20,000 #/hr. (estimated)
- 275 psig return is 40% of production
- 40 psig veturn is zero 275 pig undensate return temp. is 60F
- outhalpy Steam plant temp. pressure

415a (400 prig) throtle 750 F 1389 290a (275 prig) extraction 1 684F 1360 extractions 55a (40 pris) 1254 440F 2"17 final ext.

The purpose of these calculations are to show the coal savings due to a viduction in steam use and also the amount of electricity that must be purchased to make up for the reduction in production. The method used is to perform a heat balance for the Base Case or typical operating condition, and two other cases. Case I is for a 10,000 # / hr reduction in to psig steam. Cape 2 is for a 10,000 #/hr reduction in 275 paig steam. Whas and every balances are performed around the deacrator toute (DA). and the The turbine/generator performance curves are used to calculate the final extraction on thaloy. It is further assumed that a reduction in steam load at the point of use will & result in a reduction in steam production,

SUBJECT Radford Turbine	AEP NO
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- · Calculate final exhaust anthology
- · Use the turbino/generator performance graph with no extractions to get flow and power values
- · Knowing the throttle flow enthalpy is 1389 Btu/16 (see assumptions) the exhaust enthalpy can be calculated

where 
$$m = mass$$
 flowerste (16/hr)

where  $m = mass$  flowerste (16/hr)

where  $m = mass$  flowerste (16/hr)

and = difference between initial

and final enthologys (B+u/16)

white work done tog turbina/generator (Bm)

ng = generator eff. (20.95)

 $E_{X,2}$  20,000  $16/hr \cdot (1389 - X) Pru/16 \cdot 0.95 = 1500 kW \cdot 3413 Btu kW X = 1120 Btu/16$ 

· Cost of electricity per kwh =

where E = sal price (\$18tu)

18 = boiler If.

E = power project (kw)

time (tur)

Ex.: 1.61(#/meta)(mkta) (20,000 165/hr)(1389-69) Btu/16

PE = 3.3 4/kwh

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SUBJECT Rad ford Turbine
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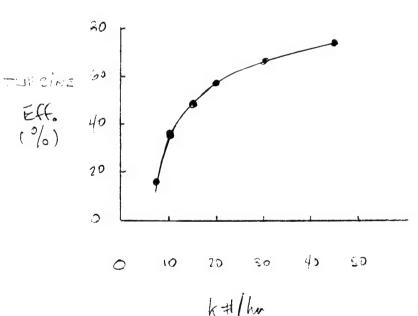
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DATE 9/20/90

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The results of the previously described calculations are shown below:

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k#/hr	EXHAUST Enthology (2"HgA	Efficiency	<u>kw</u>	24/huh
45	:046	74	4300	2.6
30	1073	67	2600	2.9
70	1120	58	1500	<i>3</i> . 3
15	1161	49	450	3.9
10	12 45	21	400	6.3
7.5	1317	16	150	12.5



K#/hr
TURBINE FLOW (NO EXTRACTION)

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BASE BASE (see recompanying diogram)

CHECKER

DA HEAT BALANCE

$$20 + m_1 + m_2 + 20 - 100 = 0$$
 $m_1 + m_2 = 60 - m_1$ 

CURSTHUTING & CEBRARY

$$m_1 = \frac{100(234) - 20(19) - (20)(28) - (60)(1254)}{(28 - 254)}$$

Power Propuction

$$0.95 \times 100 (1389-1360) + 50 (1360-1254) + 20 (1254-1120) = 3028 kw$$

SUBJECT RADFORD AAP

SHEET 7 OF 14

DESIGNER G, FALLON DATE 9-19-90

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3028 kW 大 い に 1120 h m= 20 k#/hr 2"119 ٦ -40 paig 275 psiz 17 = 30 k#/hr 2902 684F 1360 h 69 4 7101 me=16.3 55°02 440 F 1254h D. A. m = 13.7 k#/hr 4152 750 F 1389 h M = 100 K #/hr 28h M=20 KH 型差 28h hr m=0kH 26h hr 75H 275 RET (40%) 40 RET (0%) MAKE-UP BOILER N - . 85 267F 236h mistu/br SOFI 135.6

BASE CHSE

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(See accompanying diagram)

D.A. HEAT CALANCE

① 
$$\leq m = 0$$
  $20 + m_1 + m_2 + 20 - 88 = 0$   $m_1 + m_2 = 48$   $m_2 - 48 - m_1$ 

SUBSTITUTING & REGIRANGIAL

$$\frac{88(220) - 20(69) - (20)(28) - (48)(1254)}{(28 - 1254)}$$

Power PRODUCTION

$$0.95 \times 88,000 (1389-1360) + 38,000 (1360-1254) + 20,000 (1254-1120)$$

$$= 2577 \text{ kW}$$

FUEL USE

$$Q = \frac{M\Delta h}{R} = \frac{88(1389 - 236)}{.35} = \frac{119,369}{119.4} \frac{KBTU/R}{MBHJ/hr}$$

SUBJECT RADFORD AAP

SHEET 9 OF 14

DESIGNER G FALLON

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Kw = 2.577 kW			
	BOILE R 1254h N= 18 K#/hr 1120h m= 20 K#/hr	275 RET 28h 40 RET 28h 75 RET 28h 40 RET 28h 75 RET 28h	267F 23.7 247F 236h
	7 - 7		

H	So	H
		R

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CASE 2 10,000 =/AR LEDUCTION IN 275 1213 FLOW

D.A HEAT BALANCE

$$16 + m_1 + m_2 + 20 - 88 = 0$$
  
 $m_1 + m_2 = 52$   
 $m_2 = 52 - m_1$ 

SUBSTITUTING & REM. RANGITZ

$$m_1 = \frac{88(224) - 20(69) - (16)(28) - 52(1254)}{(28 - 1254)}$$

rower PRODUCTION

$$0.95 \times 38,000(1389-1360) + 48,000(1360-1254) + 20,000(1254-1120)$$

$$= 2873 \text{ kW}$$

HEAT INPUT

$$Q = \frac{m \circ h}{n} = \frac{88(1389 - 236)}{0.85} = \frac{119.4 \text{ MStu/hr}}{}$$

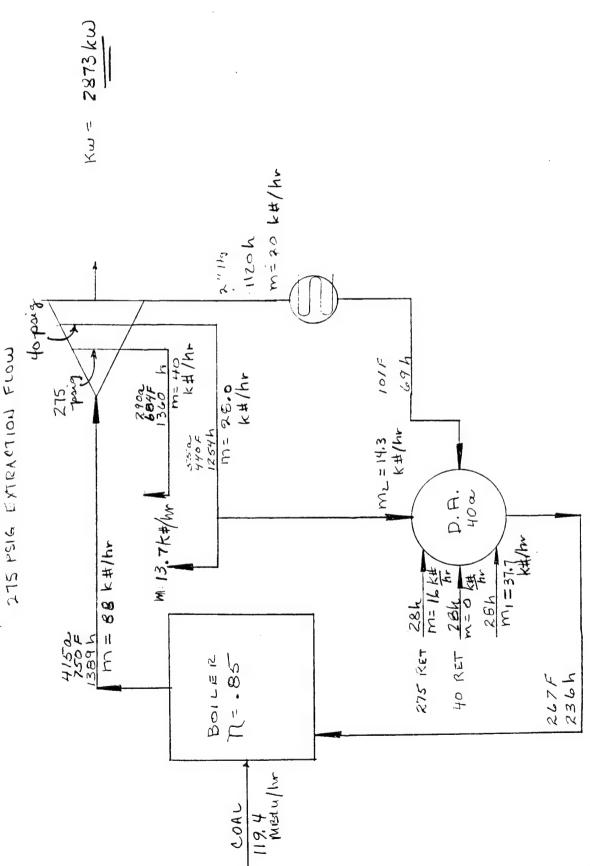
10,000 # (hr REDUCTION IN

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CASE

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SUBJECT RADFORD AAP	AEP NO				
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CALCULATE ENERGY FUEL SAVINGS AND EFFECT OF REDUCED POWER GENERATION DUE TO EAVING 40 PSIG STEAM

REFERENCE: HEAT BALANCES
(BASE (ASE & CASE 1)

COAL SAVINGS PER MBHU OF 40 PSIG STEAM SAJED

$$\frac{(135.6 \, \text{MBtu/hr} - 119.4 \, \text{MBtu/hr})}{(10,000 \pm /\text{hr})(1254h - 28h) * \frac{\text{MBtu}}{10^{6}15t \, \text{h}}} = \frac{1.32 \, \text{MBtu coal}}{\text{MBtu}}$$

$$\frac{1.32 \, \text{MBtu}}{\text{MBtu}}$$

$$\frac{1.32 \, \text{MBtu}}{\text{MBtu}}$$

$$\frac{1.32 \, \text{MBtu}}{\text{MBtu}}$$

$$\frac{1.32 \, \text{MBtu}}{\text{MBtu}}$$

CALCULATE INCREASED COSTS INCURRED DUE TO PURCHASING ELECTRICITY RATHER THAN PRODUCING IT ON-SITE

= \$1.11 ADDITIONAL PURCHASED ELECTRICITY COSTS

PER MISTU 40 PSIG STRAM SAVED

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CALCULATE THE FUEL SAVINGS DUE TO 275 PSIG STEMM REDUCTION)

275 PSIG SAVINGS FACTOR - USING HEAT BALANCES

(PASE CASE & CASE 2)

COK SAVINGS PER WISTU OF 275 PSIG STEAM SAVED:

$$\frac{(135.6 - 119.4) \, \text{MBHu/hr}}{(10,000 \, \#/\text{hr}) (1360 - 78) \, h} = 1.21 \, \text{MBTu}$$

CALCULATE ADDITIONAL COSTS INCURRED DUE TO PURCHASING ELECTRICITY RATHER THAN PRODUCING IT ON-SITE

$$= \frac{(3028 - 2873) \text{ kW} \times (0.03026 + /\text{kwh})}{(10,000 + /\text{kw}) (1360 - 28) \text{ h}}$$

= # 0.35 ADDITIONAL PURCHASED ELECTRICITY

COSTS FER MBTH 275 PSIG

STEAM SAVED

REYNOLDS. SMITH AND HILLS		SHEET /
ARCHITECTS · ENGINEERS · PLANNERS	DESIGNER	DATE
INCORPORATED	CHECKER	DATE

( MRSTEN STEAM)

CALQULATIONS EVINWARY

STEAM SAUWGS FACTORS

COAL SAUINGS

40 PSIG : 1.32

275 PSIG : 1,21

ADDITIONAL COSTS ASSOCIATED WITH ELECTRICITY PURCHASE (#/mBTC1 STEAM) VERSUS GENERATION

40 PSIG : \$ 1.11 275 PSIG : \$ 0.35



VA. S.C.C. TARIFF NO. 13

Seventh Revision of Original Sheet No. 9-1 VA. S.C.C. TARIFF NO. 13 Cancelling Sixth Revision of Sheet No. 9-1

### SCHEDULE I.P. Industrial Power Service

#### AVAILABILITY OF SERVICE

This rate Schedule is available for industrial, railroad, or pipeline customers having capacity requirements equal to or greater than 7,500 KW. Service shall be delivered and measured at voltage levels which have been designated as primary distribution, subtransmission, or transmission voltages for service in the general area, but not less than 2.4 KV. Each customer shall contract for a definite amount of electrical capacity in kilowatts which shall be sufficient to meet the customer's normal maximum demand, but in no case shall the capacity contracted for be less than 7,500 KW. The Company shall not be required to supply capacity in excess of that for which the customer has contracted. Contracts shall be in multiples of 100 KW.

MONTHLY RATE		DELIVERY VOLTAGE	
	Primary Distribution 2.4-40 KV (\$)	Sub-Transmission 41-90 KV (\$)	Transmission Above 90 KV (\$)
Customer Charge	183.00/month	538.00/month	876.00/month
Demand Charge: Each KW of monthly billing demand	7.77/KW	7.12/KW	7.66/KW
Energy Charge: All Billing KWH	0.00184/KWH	0.00092/KWH	0.00068/KWH
Reactive Demand Charge: For each KVAR of lagging reactive demand in excess of 50% of the monthly billing demand	0.59/KVAR	0.59/KVAR	0.59/KVAR
Levelized Fuel Factor: All Billing KWH	0.01589/KWH	0.01589/KWH	0.01589/kWH
MEASUREMENT AND DETERMINATION OF DEMAN	ND AND ENERGY	.01681	

The billing demand in KW shall be taken each month as the highest single 30-minute integrated peak in KW as registered during the month by a demand meter or indicator, or, at the Company's option, as the highest registration of a thermal type demand meter or indicator, but the monthly billing demand so established shall in no event be less than 60% of the contract capacity of the customer, nor less than 7,500 KW.

The reactive demand in KVAR shall be taken each month as the highest single 30-minute integrated peak in KVAR as registered during the month by a demand meter or indicator, or, at the Company's option, as the highest registration of a thermal type demand meter or indicator.

Billing KWH shall be metered KWH, except, when the Company elects to measure energy at the secondary side of transformers owned by the customer, billing KWH shall be metered KWH multiplied by 1.04, billing KW shall be metered KW multiplied by 1.04, and billing KVAR shall be metered KVAR multiplied by 1.04.

#### EQUIPMENT SUPPLIED BY CUSTOMER

Customers who as of October 7, 1983, owned, operated and maintained all equipment and apparatus beyond the delivery point of service, were receiving equipment credit for such ownership, and whose service was supplied at a delivery voltage of 34,500 volts (primary delivery voltage) shall receive a credit of \$0.51 per KW of monthly billing demand.

#### MINIMUM CHARGE

This Schedule is subject to a minimum monthly charge equal to the sum of the customer charge, demand charge, energy charge, reactive demand charge of the monthly rate, levelized fuel factor, and credits as determined under the clause "Equipment Supplied by Customer."

VA. S.C.C. TARIFF NO. 13

First Revision of Original Sheet No. 9-2 VA. S.C.C. TARLET NO. 13 Cancelling Original Sheet No. 9-2

## SCHEDULE I.P. Industrial Power Service (continued)

#### PAYMENT

Bills are due upon presentation. Any amount due and not received at the main or branch offices, or authorized collection agencies, of the Company within twenty (20) days of the bill preparation date shall be subject to a delayed payment charge of lal. This charge shall not be applicable to local consumer utility taxes.

#### TERM OF CONTRACT

Contracts under this Schedule will be made for an initial period of not less than two (2) years and shall continue thereafter until either party has given twelve (12) months written notice to the other of the intention to terminate the contract. The company will have the right to make contracts for initial periods longer than two (2) years.

#### SPECIAL TERMS AND CONDITIONS

See Terms and Conditions of Service.

Seventh Revision of Original Sheet No. 6 VA. S.C.C. TARIFF NO. 13 Cancelling Sixth Revision of Sheet No. 6

VA. S.C.C. TARIFF NO. 13

## SCHEDULE S.G.S. (Small General Service)

#### AVAILABILITY OF SERVICE

Available for small general service customers with normal maximum electrical capacity requirements of less than 300 KW per month.

When a customer being served under this Schedule establishes or exceeds a normal maximum requirement of 300 KW per month, the customer will be placed on the appropriate rate Schedule and required to contract for such capacity requirements.

#### MONTHLY RATE

All Metered KWH . . . .

1.589¢ per kwH

.0405

DETERMINATION OF BILLING DEMAND

The billing demand in KW shall be taken each month as the highest registration of a 15-minute demand meter or indicator.

Industrial and coal mining customers having 10 KW or higher normal maximum demand shall contract for capacity sufficient to meet their normal maximum requirements in KW. Monthly billing demands of these customers shall not be less than 60% of contract capacity. Monthly billing demands will be rounded to the nearest tenth.

#### EQUIPMENT SUPPLIED BY CUSTOMER

When the customer owns, operates, and maintains the complete substation equipment, including any and all transformers and/or switches and/or other apparatus necessary for the customer to take his entire service at the primary voltage of the transmission or distribution line from which said customer is to receive service, a credit of \$0.30 per KW of monthly billing demand will be applied to each monthly bill.

#### MINIMUM CHARGE

This Schedule is subject to a minimum monthly charge equal to the customer charge, plus such additional charges as are derived from application of the demand charge, energy charge, levelized fuel factor and, if applicable, equipment credits.

#### PAYMENT

Bills are due upon presentation. Any amount due and not received at the main or branch offices, or authorized collection agencies, of the Company within twenty (20) days of the bill preparation date shall be subject to a delayed payment charge of 14%. This charge shall not be applicable to local consumer utility taxes.

#### TERM

Variable, but not less than one (1) year initial period and shall continue thereafter until either party has given sixty (60) days written notice to the other of the intention to terminate the contract.

#### SPECIAL TERMS AND CONDITIONS.

See Terms and Conditions of Service.

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Issued April 28, 1989 Pursuant to Order Dated April 28, 1989 Case No. PUE 890023

Effective: May 1, 1989

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OCT 26 18 11 (2) CONTROL OF ARMY AMMUNITION PLANT

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	OCTGEER	1985	
	Please Return This Por		Lact Pay Date After Last Pay Date Add Pay This Amount
	With Your Payment	rtion	* 75.43E4.67 *
	Meter Types K - Kilowatt Hour D - KW Demand A - KVA Demand R - RKVAH	Codes E - Estimated C - Meter Change O - Off Peak	Account Number: (Please Use When You Call or Write)  2 L11 54 LL250 1 1  Service Address HERCULES INC
	V - KVAR Demand		RADECED VA 24141
	Month OCTOBER	1989 Sched	edule 393 IP SUB Office PULASKI
	Service	Meter Previous	Present Law.
	From To		Readings Constant Usage Voltage C
		01665	1583-CCO E-30 10004 :
	Contract Capacity	13,000	PR. die GEE DAN VINCHER STAR VINTAGE
			TOTAL ARU THIN COUNTY
	Billing KVAR RKVAH	28.0	LATE PAYMENT CHARCE NO
	Metered Demand	19,952	PREVICUS BALANCE TOTAL AMCUNT DUE  10-14-4-1-4-7
ĺ	Power Factor		,
1	Billing Demand	19,952	(a 7.12 #/KW
	Metered KWH	11,655,000	
	Power Factor Constan		( 0.01681 \$/ KNH TIME TOWN
	Adjusted KWH Voltage Ag. KWH	11,655,000	
	Billing KWH	11,655,000	1000 July 1000 1000 1000 1000 1000 1000 1000 10

APPALACHIAN POWER

MAIL CATE

18 = 30%

10-25-89

IF PAID AFTER NOV 14 ADD \$5,151.55

## COAL MARKETING CORP.

P. O. Box 734 ABINGDON, VIRGINIA 24210 (703) 628-4507

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Hercules Incorporated

Radford Army Ammunition Plant

Radford, VA

SHIPPED TO: Pepper, VA

FOR PH NO I

=======ER NO.	MINE NAME	MINE # 576	10-23-89	1NVOICE NO. 2036	SALESMAN George Barker
	DESCRIPTION	1	UANTITY SHIPPED	PRICE PER TON	AMOUNT
	SOU 76229     NW 14469     SOU 78469     SOU 76034     SOU 77190     NW 139419     NW 8942     SOU 360916     SOU 360913     NW 119799     NW 118425     NW 138726     NW 10173     NW 75591     NW 92959     NW 132898     NW 132303     NW 116381     NW 142009     NW 132913     NW 142009     NW 132913     NW 74668     NW 119793     NW 92796     NW 93220     NW 11910     NW 9105     NW 9105     NW 9105     NW 138706     NW 166672     SOU 360629     SOU 351004     SOU 360769     SOU 76739	92 93 106 93 94 95 96 96 97 97 97 97 97 97 97 97 97 97 97 97 97	5.00 2.95 3.10 3.20 3.15 3.60 3.45 3.45 3.45 3.45 3.45 3.45 3.55	\$25.68	\$ 2,696.40 2,386.96 2,544.89 2,727.22 2,555.16 2,520.49 2,480.69 2,537.18 2,479.40 2,399.80 2,334.31 2,428.04 2,451.16 2,322.76 2,146.85 2,146.85 2,146.85 2,413.92 2,452.44 2,421.62 2,389.52 2,505.08 2,375.40 2,024.87 2,351.00 2,402.36 2,448.59 2,406.22 2,442.17 2,490.96 2,574.42 2,589.83 2,535.90 2,657.88 2,634.77 2,487.11 2,589.75 2,634.77 2,487.11 2,589.75 2,585.98
		3,45	5.65 tons	\$25.68	\$88,741.10

MAILING ADDRESS POST OFFICE 30X 190

MINERS AND SHIPPERS OF BITUMINOUS COAL SINCE 1910

INVOICE NO.

KALAMAZOO, MICHIGAN 49005

23893

D # #2

PHONE AREA CODE 616 343-5531

YOUR ORDER NO. NVOICE DATE VT 23457 9-30-89

ROUTE N/S

6032

Hercules, Incorporated Attn: Acct. Pay.

Caller Service 1

Radford Army Ammunition Plant

kadford, VA 24141-0299

Cowan, VA

DATE		CAR		POUNDS	DATE	CAR		POUNDS
HIPPED	INITIAL		NUMBER	POUNDS	SHIPPED	INITIAL	NUMBER	
20-89	NEW	66 1432 72	06	1734 1777 1 <b>73</b> 2				
				+ FRT	+T 14,	13 Ton		
NVOICE		ARS	POUNDS	TONS	PRICE	AMOUNT		PAY THIS
OTALS		3	5243	262.15	28.50	7,471.28		AMOUNT

UNITED CITIES GAS COMPANY

703-639-1661 

ADDRESS INQUIRIES TO THIS ADDRESS
TN 37601-006 P.O. BOX 60 JOHNSON CITY

DATE RENDERED 1 1/02/89

ACCOUNT NO

67-0020643-01

23 DUE DATE

11/20/89

AMOUNT DUE

\$10,656.18

RADFORD ARSENAL % MS. ANN KING BOX 1 RADFORD

24141

TOTAL PAYMENT \$

#### PLEASE RETURN THIS PORTION WITH YOUR PAYMENT

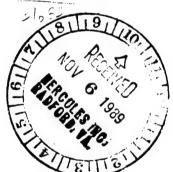
UNITED CITIES GAS COMPANY

BRING BOTH PORTIONS TO PAY IN PERSON

RATE LLASS	METER READING 19771	t i i	METER R	EADINGS CURFERS	MULTIPLIER OF FREEC PERACTOR	BTU FACTOR	COF THERMS	PURCHASEL GAS ALDUSTIMENT	AMOUNT
	·						++422	2204	

31569 33902

1065618



DUE DATE AMOUNT DUE AMOUNT DUE 11/20/89 \$1065618 AVAILABLE IN CUR OFFICE UPON REQUEST

1 (1 : m - 10,0000 bin

2 = 11,2 = 111th 12.36 3/MRtu)



### INVOICE

INVOICE DATE

INVOICE PAGE

10/12/89

NO. 15113 1

UID ASPHALTS . HEATING OILS . GASOLINES PETROLEUM PRODUCT TRANSPORTATION P. O. Box 12826

Ind Equipment Co.

ROANOKE, VIRGINIA 24027-02626 PHONE (703) 345-8865

FED. ID# 54-0486527

002364-000

HERCULES INC.

RADFORD ARMY AMMN. PLANT

P. O. BOX 1

SOLD

RADFORD, VA 24141 FUEL OIL ACCOUNT

SHIP

VB02602

ORDER NO.	ORDER DATE	CUSTOMER SA	LES PURCHASE AN ORDER NO.	SHIP VIA	SHIP DATE TERMS
784	10/12/89	2364	F0 #2	No ship via	10/11/89 NET 30 DAYS

PRICE QTY. SHIPPED UNIT PRICE QUANTITY ITEM NUMBER ITEM DESCRIPTION UNIT ITEM QTY. BACK ORD. EXTENDED PRICE 7,192 GL D/S #2-TL FUEL OIL #2 -TRAILER LOAD HGL 59.95

4.311.60



ROAD TAXES Fed 0.00 State 0.00 Total 0.00 SALE AMOUNT 4,311.60 MISC. CHARGES .00 **FREIGHT** .00

INANCE CHARGE IS COMPUTED BY A "PERIODIC RATE" OF 1 1/2 % PER MONTH (OR A MINIMUM CHARGE OF 50 CENTS PER MONTH ON BALANCES NOER \$50) WHICH IS AN ANNUAL PERCENTAGE RATE OF 18% APPLIED TO ALL CHARGES OF ITEMS WHICH HAVE BECOME MORE THAN 30 AYS PAST DUE. FUEL OIL AND EQUIPMENT CO., INC. ROANOKE, VIRGINIA LEASE PAY FROM THIS INVOICE. NO STATEMENT WILL BE SUBMITTED UNLESS REQUESTED.

**SALES TAX** .00 TOTAL 4.311.60 PAYMENT REC'D.

BALANCE DUE

### WEBB'S OIL CORPORATION

P.O. BOX 7098 ROANOKE, VIRGINIA 24019-0098 (703) 362-3795

## 56245

## INVOICE

INVOICE DATE	INVOICE,	PAGE
11/02/89	42875	1

439130-005

SOLD

HERCULES AEROSPACE DIV HERCULES INCORPORATED RADFORD, VA 24141-0299 SHIP

HERCULES AEROSPACE DIV HERCULES INCORPORATED RADFORD

\* (J-1\*

 ORDER NO.
 ORDER DATE
 CUSTOMER NO.
 SALES-MAN
 PURCHASE ORDER NO.
 SHIP VIA
 SHIP DATE
 TERMS

 46.187
 11/01/83
 439130
 VL-02755
 TRUCK
 11/02/85
 NET -10-178

JANTITY OR RDERED UN	D QUANTITY SHIPPED	QUANTITY BACK ORD.	ITEM NO.	ITEM I	DESCRIPTION	UNIT PRICE	PRC. UNIT	EXTENDED PRICE
237.0	7237.	Ů.	12	# 2 HEATIN	G OIL	<b>5</b> 9. 25	HĞ	4,287.92
							N NO NO	0 6 1989 100.
_		•	HE: HE:	0.00	State 0	.00 Tota	ì	0.00

THHAS YOU FOR YOUR ORDER

Terms NET 10 DAYS Due date 11/12/89

SALE AMOUNT 4, 287. 92

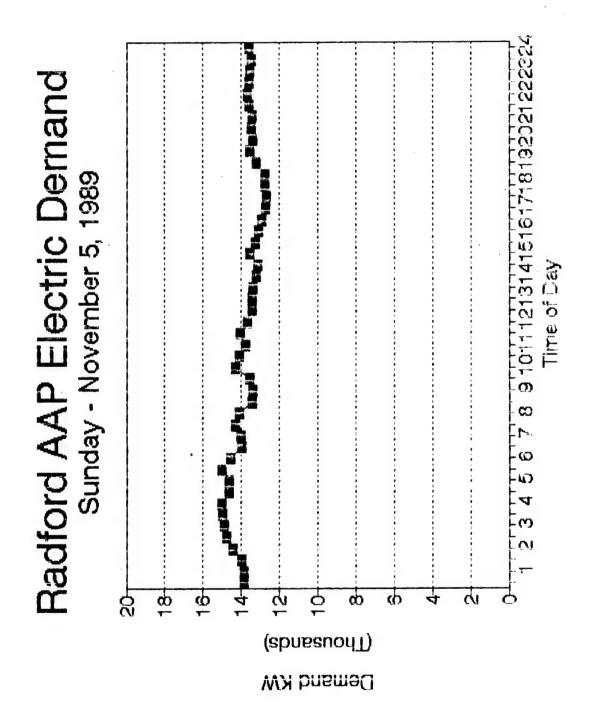
MISC. CHARGES . 00

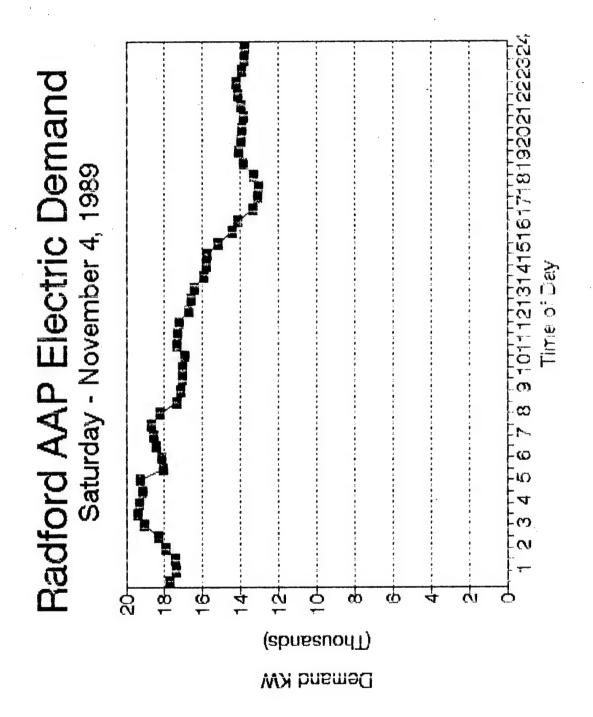
SALES TAX . 00

FREIGHT . 00

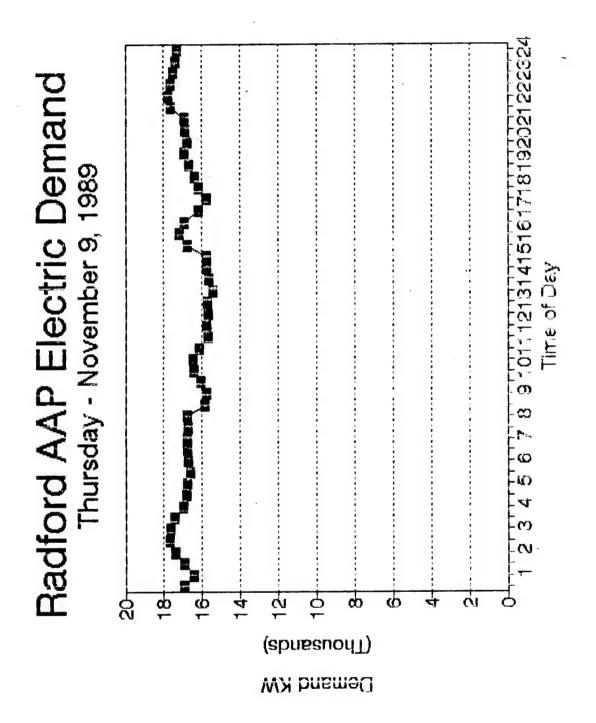
TOTAL 4, 287. 92

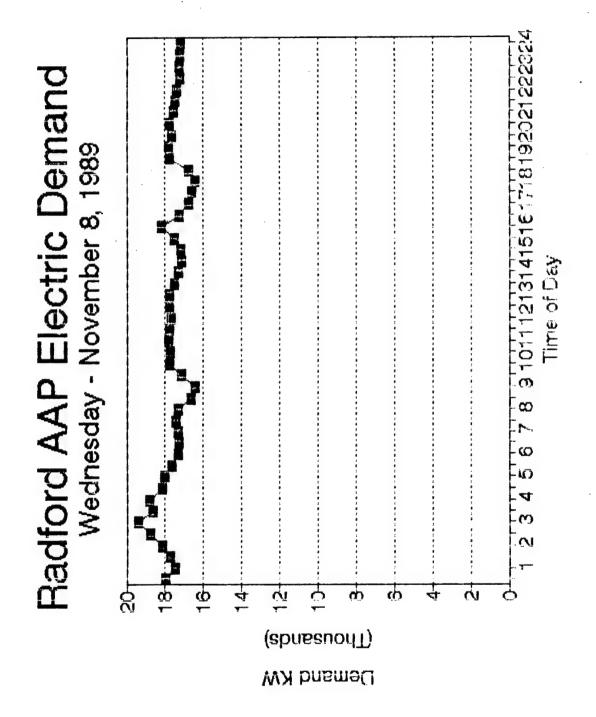
PAYMENT REC'D

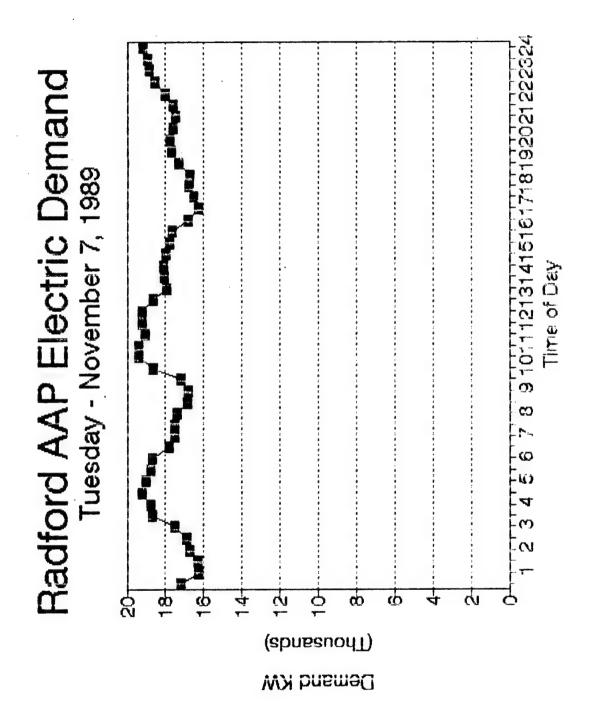




9 101112131415161718192021222324 Radford AAP Electric Demand Friday - November 10, 1989 N 4 ÷ <u>0</u>0 Ø d Š (Lyonaguqa) Demand KW







Radford AAP Electric Demand Monday - November 6, 1989 9 1011121314151617 တ Ø <u>a</u> ÷ <u>ф</u> ത Ų g (Lyonaguqa) Demand KW

# ENERGY DISTRIBUTION ANHLYSIS BACKUP

ELECTRICITY	SUMMER (1/89)	WINTER (8/89)	AVERAGE	1	ASSIGNED AREA
PH#1	1,070,000	1,517,000	1,293,500	9.9	UTIL
BUS LOSS	227,850	595,550	411,700	3.1	UTIL
CAST PROP	546,590	576,580	561,585	4.3	S'LESS
SOLVENT	2,440,031	2,170,701	2,305,366	17.6	SOLVENT
SOLVENTLESS	1,702,616	1,885,691	1,794,154	13.7	S'LESS
NG	178,542	349,109	263,826	2.0	OTHER
ACID	1,660,940	1,200,914	1,430,927	10.9	ACID/NC
NC	2,296,520	1,213,374	1,754,947	13.4	ACID/NC
TNT	10,800	9,600	10,200	0.1	OTHER
WASTE ACID	204,575	201,737	203,156	1.6	ACID/NC
PLANT WATER	721,000	800,000	760,500	5.8	UTIL
CAST WATER	61,295	102,960	82,128	0.6	UTIL
PLANT AIR	420,480	386,880	403,680	3.1	UTIL
PH #2	129,759	216,948	173,354	1.3	UTIL
ASBP	1,146,000	333,240	739,620	5.6	ADM/HEAT
AMBP	741,000	15,000	378,000	2.9	ADM/HEAT
HOUSING	18,490	23,624	21,057	0.2	ADM/HEAT
OTHERS	216,800	222,160	219,480	1.7	OTHER
INDIRECT	359,712	234,932	297,322	2.3	OTHER

		•	
	PLANT	z	
	<	POWER DISTRIBUTION	
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DISTRIBUTED POUR

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	8	47	0.8)	15,6	2.9	0.01	10.1	1.1	99	0.7	3.7	1	8./	2.8	0.																		-					7	1	01	<b>.</b>	1						٠	6,1
	X	576	2,170,701	0000	90144	1.21.00201	CO20 1000		000,000	102,960	386,880	0	610,748	15 000	00000				726	1,447	T,089	1,920	1,259	976	2,057	1,125	920	~ 40	1.480	2,002	775	516	806	17.2	1,658	\$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	***	23.624		215,000	1.400	5,760	0			245,784	9.708.518		234,932
PLANT:	ACCO	5 6	SOLVENT FROFELLANT		ACID	NITROCELLULOSE		ACI.	PLANT WATER	3	PLANT AIR	DALFE LATINE 3		ARBP	TOTAL PLANT USAGE			>	Z	i		HOUSE NO 4			A CONTRACTOR	1		NO 1	NO 4		0	0 0		- 1	2 2	2 0 0		TOTAL STAFF VILLAGE		ROAISA 450		OF	CENTEX (CONTRACTOR)			TOTAL OTHERS USAGE	TOTAL METERED USAGE		TABLET USAGE
1989			2,543,000	2.695.000	2,954,000			.517	7.4	20000000		12.056.000		20.		22		17.940			Notion	÷ 5	147.900	0000017	346-000	130,000	87,000	616,000	148,000	100.000	0004086	000	A14.000	44 4 33	000110		5,970,200		STRIBUTION	755.000	062.240	20000	•	247	15.000	3,973,250	9,943,450	505.550	
JANUARY, T	POVER HOUSE GENERATION	101		GENERATOR NO 3			L GENERATION	POWER HOUSE USAGE	H	CHASED		TOTAL GENTPURCH POWER		GENERATED PEAK DEMAND	PEAK		D1/D4/89 TIME	AVERAGE MONIHLY KU		BOURD BALLAND	MANC	A FILODALTE	2 51 30001 CT	SHOPS	PEL	<	A NITROC 1	B PROPEL 2	B NITROC 2	S JOKDAN Z	TO-13 WATFBURS 28	C PROPEL 2	LIGHTING	C NITEDS 2	DM AREA 3		SUBTOTAL PUR HSE DIST		69KV LOOP DI	33 TNT 433	7 dwild 5	A PART A	7 600 6	ASBP 4	O AMBP	SUBTOTAL LOOP DIST.	TOTAL POWER DIST.	BUS LOSS	

	RADFORD RMY AMMUN	F DA/30/88 F AMMUNITION PLANT OWER DISTRIBUTION	DISTRIBUTED POWER	O TO		Ö				١ - ر
-	AUGUST, 1	988	PLANT:			tues?	21.21.3	Ada		)
<u> </u>	7 3 3 11	V	AW	KWH		થ	12	7.	<u> </u>	. (
-	NO 1	NAME OF COLUMN	CAST PROPELLANT			3.9	4.7	4.	<u> </u>	ار
÷		2.213.000	N .	031		17.7	18.0	2,7		3
	- 1		NITROGLYCERIN	178.542	1.702,616.	12.0	15.6	9.0	. :	Ç
	GENERATOR NO 4	0	ACID	1.660.940		C:	000	6.7		)
<u>.</u>		5.270.600		2		7.5/	0.0	24	<u> </u>	(
	POWER HOUSE USAGE	1,070,000 7.6 17.9	10,3 WASTE	204.575	10,800.	F 1	1	7		
= 2	NERATION	200.000	WATER	721,000		ιή	<u>e</u> .	96,4		
_	8	8,883,000	PLANT ATR	61,295		٥,4	1,0	0.7		)
		,	111	00 * 10 7 *		05.	3.5	B.(	E 8	1
	TOTAL BEN+PURCH PONER	14,153,000	POWER HOUSE 2	129,759		6.0	00.	·		<u></u>
-				1,146,000		0.8	8,2	9'-		æ
Ţ	PURCHASED PEAK DEMAND	. 12	TOTAL PLANT USAGE	12.260.148		2.5	••	2,7	2.2	Ú
. 8	TOTAL PEAK DEMAND							-	7	)
7		21-04	5:	*						(
8	The same of the sa	10013	HOLICE NO 1	016						
			HOUSE NO 2	8 2 8 2 8		4.200,0	000			
	CV4 NOUSE DISTRI	STRIBUTION	HOUSE NO 3	865		2 33%	0.40			$\cup$
£	15 FLOODITG	102 700	HOUSE NO A	727		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			E 2	
à	LIGHTING	179,000		7.185					7	1
		158,200	NO 7	-						)=
	A JORDAN	163.000	HOUSE NO 8	142		11 11 11 11				
28.0	A WITHOU	000.89	NO 10	25.C						)
R S	8 B PROPEL 22	749,000	2	780					3 3	
	B JORDAN 2	231,000		0.000						ر
3 3	10-13 MATERUKS 24	2,060,000		1,843						_(
L	V C PROPEL >	000.00*	ON	553						
	LIGHTING 2	531,000	HOUSE NO 16	261		A Company of the Comp				
	12 C NITROC	76		1.852	, m.,					
	17 ADM AREA 3	0	SE NO 1	1,167						
	SUBTOTAL PUR HSE DIST	7,593,900	HOUSE NO 20	009						U
	69KV 100P DISTRIBILLY		TOTAL STAFF VILLAGE	18,490		ਰ	0,2	0.2		
	TNT 433	•				ì				(
	189 4	767.250	ATET	208,800		1.5	81	٤		
•	PUMP		S OF ENGINEER	5,600				And the state of t		(
	200	1,227,000	CENTEX (CONTRACTOR)	0						)
	39 ASBP 439	1,312,000					-		3 5	
	A M B D	741,000			•					<b>(</b> )
	SUBTOTAL LOOP DIST.	5,261,250	TOTAL OTHERS USAGE	235,290					3 2	<b>=</b> (
Ĺ	TOTAL POWER DIST	12,855,150	TOTAL METERED USAGE	NY 2. 505.51					<u>ر</u>	ز
7	330 - 318	0 0 0							2 3	(
_;		6.4.4.9 10.4.9	3.3 INDIRECT USAGE	359,712		2.5	6.1	2,2		ر
									. (	٠(
!									<b>ア</b>	)'1

COAL - PH≸1				TOTAL (MBTU/YR)				
ELECTRICITY GENERATION	_	_		599,111	(#2)	16.5	117 [ ]	
AOP				39,256				
NAC/SAC (2)	10,720 49 707	70	in	440,874		14.5	ACID/NC	
COTTON DRY (1)	2 224	70	10	20,660		n 7	ACID/NC	
CUITON DRT (1)	12 210	07	n.	272 254		12.2	ACID/NC	
NITRATOR (1)	42,300	- 70		372,354 115,394 61,544	1#31	3 8	ACID/NC	
BOILING TUBS (1 HOUSE)	_	_		41 544	(#3)	2.0	ACTO/NC	
	1 000	70	20	7 100		0 0	COLUCIA	
DEHY (2)	1,072	7.2	20	22 252		1.1	CULTENT	
MIX HOUSES (5)	5,060	7.0	O.	33,333		2.7	COLUENT	
VERTICAL PRES/CUT (4)	16,844	72	20	111,026		3./	SULVENT	
HORIZONTAL PRESS/CUT (2)	7,246	72	20	4/,/62		1.6	SULVENT	
SOLVENT RECOVERY (7) WATER DRY (6)	8,196	72	20	54,023		1.8	SULVENT	
WATER DRY (6)	16,740	72	20	33,353 111,026 47,762 54,023 110,341		3.6	SULVENI	
OPEN AIR DRY TANK BLDGS (4)								
BLDG (2)	9,504	36	50	31,322		1.0	SOLVENT	
BLOG (2)		72	20	49,858		1.6	SOLVENT	
ACTIVATED CARBON RECOVERY (2)	26,832	72	20	176,861		5.8	SOLVENT	
ETHER STILL (1)	11,986	72	20	79,005		2.6	SOLVENT	
CAUSTIC SCREEN (1)	655	72	20	4,317		0.1	OTHER	
4TH R.P. (ALL)	38,754	72	20	255,444		8.4	S'LESS	
1ST R.P./FINISHING/CURING/ETC.	35,094	72	20	231,320		7.6	S'LESS	
PASTE AIR DRY HOUSES (3)	3.486	72	20	22,978		0.8	S'LESS	
CASBL BLDG HEAT	5,561	-		6,700	(#4)	0.2	ADM/HEAT	
COMFORT HEAT	74,865	-		90,500	(#4)	3.0	ADM/HEAT	
		TOT	•	2,961,202				
COAL - PH#2				2,961,202				
FAD BLDGS								
HEAT CYCLE (5)	32,520	77	20	192,121		6.3	S'LESS	
TEMP. CONTROL (5)	13,809	72	20	81,581		2.7	S'LESS	
NG#2	23,547	72	20	139,111		4.6	OTHER	
SMALL GRAIN CURING (6)		77	20	96,947		3.2	S'LESS	
CONDITIONING BLDGS (5)	20,180			119,219		3.9	S'LESS	
CONING/SLEEVE/PACK-OUT/#4925	817			4,827		0.2	S'LESS	
SOLVENTLESS PRESS (3)	4,983	7:	20	29,439	)	1.0	S'LESS	
COMFORT HEAT	20,180			14,500	(#4)	0.5	ADM/HEAT	
		CUM		/77 711			-	
		SUM ACT		67 <b>7,7</b> 44 677 <b>,</b> 744				
TOTAL				3,638,946				
ACT				3,638,946	<b>&gt;</b>			
TOTAL LESS ELEC GENERATION				3,039,835	5	100.0	(EXCLUDING	

<sup>(#1)</sup> HERCULES STEAM ESTIMATES

<sup>(#2)</sup> PH1 POWER GENERATION AT 29% EFFICIENCY

<sup>(#3)</sup> BASED ON 1408 #/HR, 1175 BTU/LB,930 CYCLES/YR (ECO NC-X-1), & 75 HRS/CYCLE

<sup>(#4)</sup> CALCULATED USING BIN TEMPERATURE METHOD

14,850

#### PEACETIME-STEAM REQUIREMENTS FOR PH-1

Ref: Hercules letter to COR (87-824-52) dated June 29, 1987.

Steam requirements based upon Proposed Production. Schedule dated March 16, 1987 for production levels in November 1989, an ambient temperature of 0 degrees F, 28.7% Powerhouse 1 internal steam usage and 15% line losses.

AREA LINE	00.122.125	PEAK GENERATED POUNDS OF STEAM PER HOUR	APFC: MONTHE HOUR: Lee
Oleum Plant	Not Required on a continuous	838	-0-
Start-Up and	basis, therefore net export of		
Sulfur	43,000 lbs. of steam per hr can ne	ot	
Storage Tanks	be considered to reduce peak steaments	m	
Old Ammonia	Modern AOP not in operation.	10,720	40
Oxidation			
Plant (AOP)			
One NAC/SAÇ	2 NAC/SEE	68,797	m 70
No. 735-2	-5 MMC13 KE	· ·	
One Cotton		3,224	70
Dry House			
One Improved	(c Time - 480/m + 480/no for 5.	42,368	96
Nitrator			
One Boiling	Three tubs on heat build-up		
Tub House	79 Tobs Mo 2 x 9,984 X hs =	29,952	
		•	

Six tubs on boil cycle

AF	EA, I	LINE
OR	FAC	CLITY

#### COMMENTS

APFE'T PEAK GENERATED MONTH -: POUNDS OF STEAM STEAM PER HOUR

Poacher/Blender	Three tubs on heat build-up	,
One House	19/3 8 x 9,984 x _ lurs	29,952
Required		
	Six tubs on boil cycle	
•	79/4 8 x 2.475 X _ LVS	14,850
NG Area No. 1	Required for DEGDN production,	24,750 -0 -
	not in referenced production schedule	
Two Dehy Press Houses	One house each, B-line and C-line	
· · · · · ·	2 x 546 X 24 X 3 3	1,092 786 240
Five Mix Houses	One house B-line, Four houses C-line	
	5 x 1,012 × (24×50)	5.060 3643 200
Four Vertical Press	4 x 4,211 × (24×3)	12,127,68c 16,844 m
and Cut Houses	•	
	(	521712
Two Horizontal Press	$2 \times 3.623 \times (24 \times 30)$	7,246 m
and Cut Houses	•	- 70%
		4903 200
Seven Solvent Recovery	Five on heat cycle $5 \times 1.362 \times 1.362 \times 30$	6,810
(SR) Buildings	5 x 1,362* ×/2/	
	Two on temperature control	997,920
	2 x 693 x (24 x 30)	1, 386
		12052700
Six Water Dry Buildings	Five on heat cycle	16,740 m

One on temp. control

5 x 3.348 × (24×30)

#### PEACETIME STEAM REQUIREMENTS FOR PH-1, continued

AREA LINE
OR FACILITY

COMMENTS

PEAK GENERATED
POUNDS OF STEAM
PER HOUR

Four Open Tank Air
Dry (AD) Buildings

- Five Tank Buildings One on heat build-up
One on temp. control

8.811 m

693

7504=
3,421,440

- Two Tank Buildings Two on heat build-up
2 x 3,782

720 x 7,564 =

Two Activated Carbon Recovery Buildings 2 x 13,416

19319040 720 ≠ 26,832 m

One Ether Still

House

8029920

720 × 11,986

One Alcohol Rectification

Building

29,212 \_ 0 \_

One Caustic Screen House 720 4 655 471,600

All Fourth Rolled Powder Buildings

27,902,880 720 1 38,754 m

25,207680 720 × 35,094 m\*\*

First Rolled Powder Line, RAP Finishing Building
No. 7113, One Roto-Clone Building No. 6304, One Box Wash,

One Sub-Cal LAW Curing Building, and Four First Rolled

Powder Houses...

#### PEACETIME STEAM REQUIREMENTS FOR PH-1, continued

AREA LINE
OR FACILITY

COMMENTS

PEAK GENERATED
POUNDS OF STEAM
PER HOUR

Four First Rolled Powder Houses required to meet production schedule for MK90 which increases 31,500 grains per month from referenced production schedule

Three Paste

3 x 1,162 x 720

2 50 9 923 3 486

Air Dry Houses

CASBL in Standby

Bldg HPr

5,561 m

Comfort Heat

74,865

Total steam requirements for Powerhouse 1,

539,393

during peacetime operations

- \* Use of 1,362 lb/hr for solvent recovery buildings is an estimated value. Previously supplied meter reading value of 5,000 lb/hr in referenced letter (87-824-52) dated June 29, 1987 excessively greater than previously metered or estimated values, possibly resulting from an equipment malfunction.
- \*\* Use of 35,094 lb/hr is metered value from February 9, 1987 steam balance presented in April 15, 1987 memorandum. Previously supplied meter reading of 90,628 lb/hr from June 29, 1987 letter is excessively greater than previous metered or estimated values, possibly resulting from an equipment malfunction.

m - metered value, adjusted to 0°F

1989
PEACETIME STEAM REQUIREMENTS FOR PH-2

Ref: Hercules letter to COR (87-170-108) dated September 10, 1987.

Steam requirements based upon Proposed Production Schedule dated July 17, 1987 for production levels during the winter of 1987-88, an ambient temperature of 0 degrees F. 15% Powerhouse 2 internal steam usage and 15% line losses.

AREA LINE	COMMENTS	PEAK GENERATED
OR FACILITY	monthly his i	POUNDS OF STEAM
	Mon	PER HOUR
		22 520
Forced Air Dry	Five on heat cycle $V$	32,520 m 23,414,400
Buildings	5 x 6,504 × 720	23,9,9,
	Three on temperature control	9942 420
	3 x 4,603 /720	13,809 m
NG Area No. 2		16953840 23,547 m
CAMBL		26.938 m
Six small grain	6 x 2,735* ×(74 x 30)	16,410 m
Curing Houses		
	5 x 4,036 4720	14529,600
Five conditioning	$5 \times 4.036  \checkmark  /20$	20,180
buildings	•	

<sup>\*-</sup>Use of metered value of 2,735 lb/hr from June 29, 1987 letter from Hercules to COR (87-824-52). Meter reading value of 5,703 lb/hr used in referenced letter 87-170-108 excessively greater than 2,735 lb/hr meter reading and previous Hercules estimate of 2,630 lb/hr, possibly resulting from an equipment malfunction.

#### PEACETIME STEAM REQUIREMENTS FOR PH-2, continued

AREA LINE
OR FACILITY

COMMENTS

PEAK GENERATED
POUNDS OF STEAM

PER HOUR

One coning, sleeve 817

insertion, sleeve trimming,
inspection and pack-out
building, No. 4925

Three Solventless Press 3 x 1,661

Houses

Comfort heat for remaining
buildings in Horseshoe Area

Total Steam requirements for Powerhouse 2, during Peacetime

151,347

m-metered value, adjusted to 0°F

#### COMFORT HEAT

BIN TEMPS	TOTAL HRS	EST'D #/HR	MBtu/YR
50-54	707	10,000	7,424
45-49	682	15,000	10,742
40-44	702	20,000	14,742
35-39	687	25,000	18,034
30-34	563	30,000	17,735
25-29	292	40,000	12,264
20-24	162	50,000	8,505
15-19	82	60,000	5,166
10-14	25	70,000	1,838
5- 9	9	80,000	756
TOTAL			97,204

TOTAL = PEAK

PEAK \* 97,200 MB

80,000 #/HR

PEAK	MBTU/YR
5,561	6,700
74,865	90,500
20 180	14 500

•	40,412,470	100	
NAC/SAC 1GP DECON OVENS	9,794,607 27,180,000 3,437,863	67	ACID/NC SOLVENT OTHER
NATURAL GAS FY89	(CF)	(%)	ASSIGNED AREA
TOTAL	2,002,500	100	
PH#2 Housing Other	943,000 17,000 2,500	1	UTIL ADM/HEAT OTHER
PH#1 Incinerator	240,000 800,000	40	UTIL OTHER
FUEL OIL CY88	(GAL)	(%)	ASSIGNED AREA

.

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PH2. Ontwee 00000 2220000 1848 1848 1872 1872 1888 00000000 D O 5 00000000 口 Topological states

) 53,729AC

Consumption grant

#### NATURAL GAS USAGE 1989

						•								FT		_
,	HTHO	ı	NAC/SAC		I INERT GA	5 PLANT	1	DECON DV	ENS	l	SAR		I	•		l
	CHARGED	i	620-164004	•	745-244	000	I.	594-20406	0	16	20-164104		1	TOTAL	TOTAL	١
	JUT	i	QTY	\$	g QTY	\$	1	QTY	\$	1	QTY	\$	l	QTY	5	1
,	,,, =========	=			========		: =	========	======	=   =		=====	=			I
	JANUARY	i	360,527	1,222	1 2,573,000	8,723	1	173,573	588	I	0	0	1	3,107,100	10,533	
	FEBRUARY	i	1,284,444		1 1,937,000		1	566,856	2,250	1	0	0	ľ	3,788,300	15,036	
1	(ARCH	i	681,357		1 2,121,000		1	289,443	2,529	I	0	0	1	3,091,800	27,015	
1	APRIL	i	648,595		1 2,383,000			404,105	1,415	t	0	0	ł	3,435,700	12,032	
	MAY	i	532,879		1 2,150,000		•	175,921	955	1	0	0	l	2,858,800	10,101	1
	JUNE #	i	330,225		1 2,014,000		1	110,075	0	I	.0	0	١	2,454,300	0	İ
	JULY +		136,015	, 0			I	111,285	0	1	0	0	i	1,173,300	0	
	AUGUST 3		448,056	1.042	1 1,080,000	2,087	I	174,244	393	1	0	0	1	1,702,300	3,522	
	SEPTEMBER		543,925		1 1,354,000		1	213,375	743	1	0	0	l.	2,111,300	7,349	
	OCTOBER	ī	261,823		1 2,089,000		1	53,477	181	1	0	0	İ	2,404,300	8,123	I
	NOVEMBER	i	221,000		1	•	1			١			1	0	0	1
	DECEMBER				I.		1			ı			ı	0	0	1
\	DE GENOLI.	i			1		1			I			1			1
1	TOTAL	i	5,227,846	20,248	118,627,000	64,742	18	2,272,354	8,721	1	0	0	1	26,127,200	93,711	1
1	olo	•	3020.	•	71.3	·		8.7								

\* NO DOLLARS CHARGED DUE TO OVERSTATEMENT OF \$15490 IN MARCH.

3 CREDIT ADJUSTMENT OF \$2651 DUE TO OVERSTATEMENT IN MARCH.

Thru October

RADFORD ARMY AMMUNITION PLANT FY 1985-89 PRODUCTION DATA

FILE NAME: DATA8589

HTMOK	PH#1 MBTU	PH#2 MBTU	COAL TOT MBTU	ELEC GEN MBTU	ELEC PUR MBTU	TOT ELEC MBTU	NC PROD LBS	AOP LBS	NAC/SAC LBS	NG LBS	GOH
Oct-84	283260	33330	316590	27133	21359	48492	3089744	5312073	8546879	436271	132
Nov-84	306783	56952	363735	25188	19638	44826	2854925	4696735	7900459	439519	680
Dec-84	394263	100041	494304	37877	23150	61028	3875115	5344706	8637984	605425	641
Jan-85	380916	83941	464857	28509	17990	46499	3311986	4363163	8363588	379338	1121
Feb-85	410240	83597	493837	27352	20355	47707	3430135	5371200	8710445	144267	845
Mar -85	437254	99008	536262	33007	24727	57734	3862863	6778329	10127458	0	586
Apr-85	312043	54670	376713	23748	21789	45536	3011494	4273522	7219176	Û	312
May-85	274608	47415	322023	21690	22434	44123	3061532	4039199	7373783	0	97
Jun-85	304276	47562	351838	25574	29529	55103	3768219	5400836	10606032	0	31
Jul -85	235132	34068	269200	19529	25659	45188	2585736	5033050	8061918	0	0
Aug-85	279892	44318	324210	22949	32253	55202	3347315	5994096	8691353	Û	15
Sep-85	224956	37534	262490	16365	25372	41738	2642476	4183251	6995404	0	101
Oct-85	238279	35420	273698	18208	23795	42004	2666589	4829712	7188631	0	244
Nov-85	362432	64449	426881	24638	26877	51516	3294400	5434380	9214510	0	356
c-85	371133	76223	447356	26946	16341	43287	2428622	3538124	5575507	0	983
Jan-86	377991	91929	469920	28662	11754	40417	2371698	3838576	6795980	87869	997
Feb-86	404710	79246	483956	27925	16987	44912	2639278	4728086	6929907	167158	773
Mar -86	430568	92986	523554	32693	19423	52117	3105896	4617368	7557531	183234	650
Apr-86	279720	55649	335370	24130	20355	44485	2171343	2295739	4220611	148704	296
May-86	260032	64916	324948	21055	28167	49222	1549930	3344565	4262647	224913	135
Jun-86	180049	42548	222596	15928	24512	40441	1075013	3500519	3600585	155107	0
Jul-86	195853	38394	234247	15174	25157	40331	1684649	4494215	5610274	169276	1
Aug-86	236460	46923	283383	22621	33615	56236	2510808	3724641	7374045	189136	20
Sep-86	205710	37214	242924	15539	21789	37328	1602221	1664775	4733546	87861	53
Oct-86	215984	42302	258287	19109	16270	35379	1849585	2718971	4180717	124797	345
Nov-86	381580	71823	453403	25185	20498	45683	1866578	2784873	5270456	194445	595
Dec-86	281711	73175	354886	23884	16628	40512	1842285	1171941	3689246	217152	897
Jan-87	408864	102646	511510	29188	15911	45099	2563214	3361257	5766875	227585	1027
Feb-87	365972	87972	453943	26877	13976	40854	2483119	2434790	5106834	178408	806
Mar -87	320843	78238	399081	24539	14621	39161	2314053	2651569	4714036	275331	666
Apr-87	302088	73937	376025	23000	18563	41564	3102295	3497919	6501074	244518	450
May-87	298377	74182	372559	21898	28956	50854	3794927	3742102	9647327	364196	90
Jun-87	211216	44932	256148	15997	25516	41512	2914324	3574194	6396072	256875	15
Jul-87	206865	45473	252338	16068	24942	41011	3034934	1859272	6822250	197917	4
Aug-87	254723	55379	310101	19809	32611	52420	3940281	5227243	10055102	384967	7
Sep-87	189020	45842	234862	16952	24512	41465	2617012	3769549	6949571	272632	75

RADFORD ARMY AMMUNITION PLANT FY 1985-89 PRODUCTION DATA FILE NAME: DATA8589

HTMOK	PH≨1 MBTU	PH#2 MBTU	COAL TOT MBTU	ELEC GEN MBTU	ELEC PUR Mbtu	TOT ELEC	NC PROD LBS	AOP LBS	NAC/SAC LBS	NG LBS	HDD
Oct-87	347242	74232	421473	28833	26161	54994	3265020	4717950	11678597	376823	<b>5</b> 47
Nov-87	283579	63564	347143	23584	19208	42792	2624519	2759250	4909316	250071	594
Dec-87	392813	91561	484373	26301	18492	44792	2863991	3229258	5954979	285035	839
Jan-88	464341	80868	545209	34260	21287	55547	3529253	3779441	7335130	333804	1220
Feb-88	307668	76640	384308	25611	18133	43744	3073848	2822051	6093826	376424	943
Mar -88	398983	71970	470953	23840	22792	46632	3422157	4964739	11088583	253766	673
Apr-88	362309	82835	445144	25601	26161	51762	3734380	4375497	9499569	269594	452
May-88	245136	47906	293043	19304	22577	41881	2761406	2904756	5556980	292462	211
Jun-88	206325	33994	240319	16604	23007	39611	2578299	2627555	6234479	158275	101
Jul-88	263227	49086	312313	19765	34475	54239	3298155	3478576	9983961	234032	10
Aug-88	220753	38615	259368	17208	30318	47526	3097861	3108895	9569329	304725	11
Sep-89	211019	40213	251232	16099	24512	40611	2812986	3203245	7305359	363272	135
Oct-88	353706	74428	428134	27127	22219	49345	3907912	4145719	11330094	446377	518
Nov-88	252879	30725	283604	22307	14335	36642	2084293	3506661	5697900	298957	597
c -88	477245	94436	571682	33253	16771	50024	3344439	3795318	6545238	464398	900
Jan-89	352674	75584	428257	25925	13188	39113	2719628	2523300	6692200	327700	828
Feb-89	320474	74527	395001	24591	13188	37778	1626232	2643400	4229800	195400	837
Mar -89	250151	70692	320843	0	27522	27522	1750724	730100	2172200	183100	659
Apr-89	286603	66735	353338	14079	31536	45615	3085460	3664300	6186100	230100	452
May-89	171372	44711	216083	20475	32038	52512	2501288	3335600	5233100	366300	290
Jun-89	94707	34142	128848	5986	21000	26987	987067	1312200	2573300	161000	10
Jul -89	91339	38836	130176	0	26806	26806	1530282	1970200	2734800	291600	0
Aug-89	135608	31118	166726	0	36482	36482	2305368	2321700	4711900	306500	31
Sep-89	174444	41811	216255	0	43577	43577	2033241	3261600	7044700	432900	119
TOTALS	17488400	3683460	21171860	1295701	1391818	2687519	163202403	218775851	409759251	13559516	25023

				OI.JI IN
Count	Bldg. No.	Name/Process	Location	Similar
1	266 -03	Refrigeration Equipment House Power House #1 Filter Plant & Pump Station River Pump House Filter Plant Drinking Water Plant Acid Waste Disposal (C-Line)	Ballistics Range	1
2	400 -00	Power House #1	Power	1
3	407 -00	Filter Plant & Pump Station	Plant Water	1
1	408 -00	River Pump House	Plant Water	1
5	400 -00	Filter Plant	Plant Water	$\bar{1}$
4 5 6	410 -00	Drinking Water Plant	Plant Water	$\overline{1}$
7	419 -00	Acid Wasta Disposal (C-Line)	Waste Acid	ī
8	420 02	Inert Gas Producer & Burn Hse.	Inert Gas	ī
9	421 -00	Cowage Disposal Plant	Waste Water	ī
	440 -00	Incinerator 6A	Incinerator	ī
	440 -00	Incinerator 6B	Incinerator	ī
11	441 -00	Sewage Disposal Plant Incinerator 6A Incinerator 6B Grind House	Incinerator	$\overline{1}$
12	442 -00	Grind House Biological Treatment Building	Waste Water	i
13	700 00	Air Compressor House	Agid	1
14 -	700 -00	Air Compressor House	Acid	i
15	702 -00	WAG (CAC Dlant	Acid	ī
10	735 -02	NAC/CAC Cooling Mover	Acid	· i
17	1000 00	Catton Linton Warehouse	NC ACR-Line	î
18	1000 -00	Change House	Green A-Line	3
19	1505 -00	Change house	Sol Decovery A-Line	10
20	1600 -00	Open Tank All Dry	Col Pogovery R-Line	27
21	1611 -00	Solvent Recovery House	Sol Bogovery C-Line	32
22	16/4 -00	Air Compressor House Oxidation House NAC/SAC Plant NAC/SAC Cooling Tower Cotton Linter Warehouse Change House Open Tank Air Dry Solvent Recovery House Water Dry House Glaze House Final Blend House Can Pack house Cotton Linter Warehouse	Binish A-line	3
23	1800 -00	Glaze House	Pinich	4
24	1827 -00	Final Blend House Can Pack house Cotton Linter Warehouse Dry House and Conveyer Boiling Tub House Beater House Poacher & Blending House Final Wringer House Control House Molecular Sieve Building Dehy Press House	Finish	3
25	18// -00	Can Pack nouse	rillisii	3 2 3 3 3 3 3 2
26	2000 -00	Cotton Linter warehouse	NC, Add-Line	3
27	2010 -00	Dry House and Conveyer	NC, B-Line	3
28	2019 -00	Bolling Tub House	NC, B-Line	3
29	2022 -00	Beater House	NC, B-Line	3
30	2024 -00	Poacher & Blending House	Croon P-Tine	3
31	2026 -00	rinal wringer house	MC P-Line	2
32	2046 -00	Control House	NC, B-Line	2
33	2050 -00	Molecular Sieve Bullding	Croon P-Tine	3
34	2500 -00	Dehy Press House	Croon P-I inc	3
35	2506 -00	Diphenylamine Mix House	Green, B-Line Green, B-Line	6
36	2508 -00	Mix House	Green, B-Line	9
37	2510 -00	Pre. & Horizontal Press House	Green, B-Line	4
38	2516 -00	Finishing Press & Cut House	Green, B-Line	
39	2521 -00	Hydraulic Pump House	Green, B-Line	3 3
40	2555 -00	Activated Carbon Vapor Recov.		3
41	3513 -00	C-1 Press & Cutting House	Green, C-Line Green, C-Line	3 2
42	3523 -00	Cooling Tower	NG #1	2
43	3647 -00	Premix House Number 1		l
44	3805 -00	Glycerin/Soda/Refrig. House	NG #1	1
45	4329 -00	Power House #2	Cast Prop. (Rocket)	1

46 47	4903 -00 4906 -00 4908 -00	Inert Gas Producer & Burn Hse. Final Mix House Press and Cutting House	Inert Gas Green, C-Line Green, C-Line	1 1 3
48 49	4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	ĭ
50	4912 -03	Vacuum & Air Conditioning Hse.	Cast Prop. (Rocket)	4
51	4912 -04	SG Evacuation and Casting	Cast Prop. (Rocket)	i
52	4912 -04	Pin Assembly *	Cast Prop. (Rocket)	ī
53	4912 -07	LG Mold Loading House	Cast Prop. (Rocket)	2
54	4912 -11	Spiral Wrap House	Cast Prop. (Rocket)	ĩ
55	4912 -13	SG Curing Hse Carpet Rolls	_ : : : : : : : : : : : : : : : : : : :	10
56	4912 - 27	Forced Air Dry House	Pilot B	2
57	4912 - 34	Forced Air Dry House	Pilot B	19
58	4915 -00	Small Grain Mold Assembly		1
59	4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	ī
60	4924 -01	LG Motor Load House	Cast Prop. (Rocket)	ī
61	4924 -05	MK 43 Dowel Rod & Spiral Wrap		1
62		Machine and Saw House	Cast Prop. (Rocket)	ī
63	4925 -00	Machine and Saw House MK 43 Finishing Operations TOW Launch Saw House	Pilot B	ĩ
64	4951 -02	TOW Launch Saw House	Pilot B	$\bar{1}$
65	5008 -01	15 Inch Press House	Pilot A	1 3
66	5010 -00	Igniter Assemble & Inspect	Igniter Line	1
67	6304 -00	Paste Blending House	lst R P	1
68	7104 -00	Diff. & Even Speed Roll House	lst R P	5
69	7106 -06	Dry House #6 (Dry Packing)	lst R P	7
70	7113 -00	Roll House (Rolled Powder)	lst R P (F-Line)	1
71	7113 -00		Grain Finish	1
72	7127 -00	Carpet Roll and Slitter House	lst R P	1
73	7801 -00	Extruded Grain Finishing	Grain Finish	2
74	9304 -00	Slurry Mix House	Premix 2	2
75	9309 -03	Rolled Powder Building	4th Rolled Powder	1
76	9309 -04	Rolled Powder Building	4th Rolled Powder	1
77	9310 -02	Rolled Powder Building Rolled Powder Building Rolled Powder Building Blender House Rest House Compressor House	4th Rolled Powder	2
78	9334 -15	Blender House	4th Rolled Powder	1
79	9334 -17	Rest House	4th Rolled Powder	8
80	9354 -00	Compressor House	4th Rolled Powder	1
	9465 -00	Glycerin/Soda/Sol/Refrig Hse.	NG #2	1
	9467 -00	Generator House	NG #2	1
83	9488 -00	Compressor House	NG #2	1

Number Of Buildings Represented By The 83 Buildings Surveyed:

255

Some ECOs are not practical, have been previously accomplished, or can be eliminated from detailed analysis based on preliminary analysis. The following pages represent the results of the preliminary evaluation of all ECOs for each building surveyed. If an ECO has been previously accomplished, causes a safety hazard, or does not apply to that building (i.e., a thermal energy storage project for a building with no air conditioning system) then it is considered "Not Applicable." Based on previous experience and engineering judgement the potential savings for some projects are very low compared to the probable installation cost. These projects are considered to have "Low Potential Savings" and were eliminated from further detailed analysis.

A. Production equipment changes Not Applicable B. Efficient motors & var. speed drive Not Applicable C. Production equipment scheduling Not Applicable D. Waste heat recovery Not Applicable E. Automated production controls Not Applicable F. Improve facility layout Not Applicable G. Solar applications Not Applicable	
B. Efficient motors & var. speed drive Not Applicable C. Production equipment scheduling Not Applicable D. Waste heat recovery Not Applicable E. Automated production controls Not Applicable F. Improve facility layout Not Applicable G. Solar applications Not Applicable	
C. Production equipment scheduling Not Applicable  D. Waste heat recovery Not Applicable  E. Automated production controls Not Applicable  F. Improve facility layout Not Applicable  G. Solar applications Not Applicable	
D. Waste heat recovery  E. Automated production controls  Not Applicable  F. Improve facility layout  Not Applicable  G. Solar applications  Not Applicable	
E. Automated production controls Not Applicable  F. Improve facility layout Not Applicable  G. Solar applications Not Applicable	
F. Improve facility layout Not Applicable G. Solar applications Not Applicable	
G. Solar applications Not Applicable	
H. Consolidate process Not Applicable	
I. Building ventilation systems Not Applicable	
J. Production equipment maintenance ECO Analysis Perfo	rmed
K. Improved methods/controls Not Applicable	
L. Steam/condensate distribution Not Applicable	
M. Compressed air systems Not Applicable	
N. Lighting systems Not Applicable	
O. Electrical distribution Not Applicable	
P. Radiant heating Not Applicable	
Q. Loading dock seals Not Applicable	
R. Thermal energy storage Not Applicable	
S. Flue gas recirculation Not Applicable	
T. Ventilation instead of A/C Not Applicable	
U. Insulation Not Applicable	
V. Reduction of glass area Not Applicable	
W. Cargo door strip curtains Not Applicable	
X. Other applicable ECO's Not Applicable	

BUILDING NAME: Filter Plant & Pump Station

ARE	BUILDING NAME: Pump Station	NUMBER: 407
	ECO Description	Project Status
Α.	Production equipment changes	NA
В.	Efficient motors & var. speed drive	LPS
c.	Production equipment scheduling	· NA
D.	Waste heat recovery	NA
Ε.	Automated production controls	NA
F.	Improve facility layout	LPS
G.	Solar applications	NA
н.	Consolidate process	NA
ī.	Building ventilation systems	LPS
J.	Production equipment maintenance	LPS
Κ.	Improved methods/controls	LPS
L.	Steam/condensate distribution	LPS
M.	Compressed air systems	NA ·
N.	Lighting systems	LPS
0.	Electrical distribution	LPS
Р.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
т.	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
Χ.	Other applicable ECOs	LPS

AREA: Plant Water BUILDING NAME: River Pump House NUMBER: 408

	ECO Description	Project Status
Α.	Production equipment changes	NA
В.	Efficient motors & var. speed drive	ECO
c.	Production equipment scheduling	NA
D.	Waste heat recovery	NA
E.	Automated production controls	NA
F.	Improve facility layout	NA
G.	Solar applications	NA
н.	Consolidate process	NA
ī.	Building ventilation systems	NA
J.	Production equipment maintenance	NA
ĸ.	Improved methods/controls	ECO
L.	Steam/condensate distribution	NA
M.	Compressed air systems	NA
N.	Lighting systems	LPS
0.	Electrical distribution	LPS
P.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
<b>T.</b>	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
Χ.	Other applicable ECOs	LPS

AREA: Plant Water BUILDING NAME: Filter Plant NUMBER: 409

	ECO Description	Project Status
<u>A.</u>	Production equipment changes	NA
В.	Efficient motors & var. speed drive	ECO
c.	Production equipment scheduling	NA
D.	Waste heat recovery	NA
Ε.	Automated production controls	NA
F.	Improve facility layout	NA
G.	Solar applications	NA
H.	Consolidate process	NA
ī.	Building ventilation systems	NA
J.	Production equipment maintenance	LPS
ĸ.	Improved methods/controls	LPS
L.	Steam/condensate distribution	NA
M.	Compressed air systems	NA
N.	Lighting systems	LPS
0.	Electrical distribution	LPS
P.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
<b>T.</b>	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
Χ.	Other applicable ECOs	LPS

AREA: Plant Water BUILDING NAME: Water Plant NUMBER: 419

	ECO Description	Project Status
Α.	Production equipment changes	NA
В.	Efficient motors & var. speed drive	ECO
c.	Production equipment scheduling	NA NA
D.	Waste heat recovery	NA
<u>E.</u>	Automated production controls	LPS
F.	Improve facility layout	NA
G.	Solar applications	NA
H.	Consolidate process	NA
<u>.</u>	Building ventilation systems	LPS
J.	Production equipment maintenance	LPS
<u>K.</u>	Improved methods/controls	LPS
L.	Steam/condensate distribution	LPS
M.	Compressed air systems	NA
N.	Lighting systems	LPS
0.	Electrical distribution	LPS
Р.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
T.	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
χ.	Other applicable ECOs	LPS

Acid Waste

AREA:	Waste Acid	BUILDING NAME:	Disposal	NUMBER:	420-02
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	ECO Description	Project Status
A.	Production equipment changes	NA
В.	Efficient motors & var. speed drive	ECO
c.	Production equipment scheduling	NA
D.	Waste heat recovery	NA
Ε.	Automated production controls	NA
F.	Improve facility layout	NA
G.	Solar applications	NA
н.	Consolidate process	NA
ī.	Building ventilation systems	NA .
J.	Production equipment maintenance	LPS
K.	Improved methods/controls	LPS
L.	Steam/condensate distribution	LPS
M.	Compressed air systems	, NA
N.	Lighting systems	LPS
0.	Electrical distribution	LPS
P.	Radiant heating	LPS
Q.	Loading dock seals	NA NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
т.	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
Χ.	Other applicable ECOs	LPS

ARE	A: <u>GP</u> BUILDING NAME: <u>Inert Gas Pr</u>	od. NUMBER: 0421-00
	ECO Description	Project Status
A.	Production equipment changes	Not Applicable
В.	Efficient motors & var. speed drive	Not Applicable
C.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	ECO Analysis Performed
Ε.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate processes	Not Applicable
ī.	Building ventilation systems	Not Applicable
J.	Production equipment maintenance	Not Applicable
ĸ.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Not Applicable
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
υ.	Insulation	Not Applicable
v.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

AREA: Waste Water BUILDING NAME: Sewage Disposal Plant NUMBER: 424\_\_\_\_

	ECO Description	Project Status
A.	Production equipment changes	NA
В.	Efficient motors & var. speed drive	ECO
c.	Production equipment scheduling	. NA
D.	Waste heat recovery	NA
E.	Automated production controls	NA
F.	Improve facility layout	NA
G.	Solar applications	NA
Н.	Consolidate process	NA
ī.	Building ventilation systems	LPS
J.	Production equipment maintenance	LPS
Κ.	Improved methods/controls	LPS
L.	Steam/condensate distribution	LPS
M:	Compressed air systems	NA
N.	Lighting systems	LPS
0.	Electrical distribution	LPS
Ρ.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
T.	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA ·
Χ.	Other applicable ECOs	LPS

ARE	A: <u>GP</u> BUILDING NAME: <u>Incinerator</u>	NUMBER: 0440-00
•	ECO Description	Project Status
Α.	Production equipment changes	ECO Analysis Performed
В.	Efficient motors & var. speed drive	Not Applicable
c.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Not Applicable
Ε.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate processes	Not Applicable
ī.	Building ventilation systems	Not Applicable
J.	Production equipment maintenance	Not Applicable
K.	Improved methods/controls	ECO Analysis Performed
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Not Applicable
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
υ.	Insulation	Not Applicable
٧.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

ARE	A: <u>GP</u> BUILDING NAME: <u>Grind House</u>		NUMBER: 442-00
	ECO Description		Project Status
Α.	Production equipment changes	Low	Potential Savings
В.	Efficient motors & var. speed drive	ECO	Analysis Performed
C.	Production equipment scheduling	Not	Applicable
D.	Waste heat recovery	Not	Applicable
Ε.	Automated production controls	Low	Potential Savings
F.	Improve facility layout	Not	Applicable
G.	Solar applications	Not	Applicable
н.	Consolidate processes	Low	Potential Savings
ī.	Building ventilation systems	Low	Potential Savings
J.	Production equipment maintenance	Not	Applicable
K.	Improved methods/controls	ECO	Analysis Performed
L.	Steam/condensate distribution	Not	Applicable
М.	Compressed air systems	Not	Applicable
N.	Lighting systems	Low	Potential Savings
0.	Electrical distribution	Not	Applicable
Р.	Radiant heating	Not	Applicable
Q.	Loading dock seals	Low	Potential Savings
R.	Thermal energy storage	Not	Applicable
s.	Flue gas recirculation	Not	Applicable
T.	Ventilation instead of A/C	Not	Applicable
U.	Insulation	Low	Potential Savings
V.	Reduction of glass area	Low	Potential Savings
W.	Cargo door strip curtains	Not	Applicable
х.	Other applicable ECO's	Not	Applicable

BUILDING NAME: Biological
Treatment Bldg. NUMBER: 470 AREA: Waste Water

	ECO Description	Project Status
Α.	Production equipment changes	NA
В.	Efficient motors & var. speed drive	ECO
c.	Production equipment scheduling	NA
D.	Waste heat recovery	NA
E.	Automated production controls	NA
F.	Improve facility layout	NA
G.	Solar applications	NA .
н.	Consolidate process	NA
ī.	Building ventilation systems	LPS
J.	Production equipment maintenance	LPS
Κ.	Improved methods/controls	LPS
L.	Steam/condensate distribution	LPS
M.	Compressed air systems	NA
N.	Lighting systems	LPS
0.	Electrical distribution	LPS
P.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
<u>T.</u>	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
<del>X.</del>	Other applicable ECOs	LPS

AREA: Plant Air BUILDING NAME: Compressor Bldg. NUMBER: 700

	ECO Description	Project Status
Α.	Production equipment changes	LPS
В.	Efficient motors & var. speed drive	LPS
c.	Production equipment scheduling	NA
D.	Waste heat recovery	LPS
Ε.	Automated production controls	NA
F.	Improve facility layout	NA
G.	Solar applications	NA
н.	Consolidate process	NA
ī.	Building ventilation systems	NA
J.	Production equipment maintenance	NA
<u>K.</u>	Improved methods/controls	NA
L.	Steam/condensate distribution	NA
M.	Compressed air systems	LPS
N.	Lighting systems	LPS
0.	Electrical distribution	LPS
P.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
<u>s.</u>	Flue gas recirculation	NA
T.	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
χ.	Other applicable ECOs	LPS

AREA: Acid BUILDING NAME: Oxidation House NUMBER: 702

	ECO Description	Project Status
<u>A.</u>	Production equipment changes	LPS
В.	Efficient motors & var. speed drive	ECO
c.	Production equipment scheduling	LPS
D.	Waste heat recovery	EXISTS
Ε.	Automated production controls	EXISTS
F.	Improve facility layout	LPS
G.	Solar applications	NA
н.	Consolidate process	NA
ī.	Building ventilation systems	LPS
J.	Production equipment maintenance	LPS
Κ.	Improved methods/controls	LPS
L.	Steam/condensate distribution	LPS
M.	Compressed air systems	NA
N.	Lighting systems	LPS
0.	Electrical distribution	LPS
P.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
<b>T.</b>	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
<del>X.</del>	Other applicable ECOs	LPS

A. Production equipment changes Not Applicable B. Efficient motors & var. speed drive Not Applicable C. Production equipment scheduling Not Applicable D. Waste heat recovery Not Applicable E. Automated production controls Not Applicable F. Improve facility layout Not Applicable G. Solar applications Low Potential Savings H. Consolidate process Not Applicable I. Building ventilation systems Low Potential Savings J. Production equipment maintenance Not Applicable K. Improved methods/controls Low Potential Savings L. Steam/condensate distribution Not Applicable M. Compressed air systems Not Applicable N. Lighting systems ECO Analysis Performed C. Electrical distribution Not Applicable P. Radiant heating Not Applicable G. Loading dock seals Low Potential Savings R. Thermal energy storage Not Applicable S. Flue gas recirculation Not Applicable T. Ventilation instead of A/C Not Applicable U. Insulation Low Potential Savings V. Reduction of glass area Not Applicable W. Cargo door strip curtains Low Potential Savings X. Other applicable ECO's Not Applicable	ARE	A: NC BUILDING NAME: Cotton Warehous	e NUMBER: 1000-00
B. Efficient motors & var. speed drive Not Applicable C. Production equipment scheduling Not Applicable D. Waste heat recovery Not Applicable E. Automated production controls Not Applicable F. Improve facility layout Not Applicable G. Solar applications Low Potential Savings H. Consolidate process Not Applicable I. Building ventilation systems Low Potential Savings J. Production equipment maintenance Not Applicable K. Improved methods/controls Low Potential Savings L. Steam/condensate distribution Not Applicable M. Compressed air systems Not Applicable N. Lighting systems ECO Analysis Performed O. Electrical distribution Not Applicable P. Radiant heating Not Applicable Q. Loading dock seals Low Potential Savings R. Thermal energy storage Not Applicable S. Flue gas recirculation Not Applicable T. Ventilation instead of A/C Not Applicable U. Insulation Low Potential Savings V. Reduction of glass area Not Applicable W. Cargo door strip curtains Low Potential Savings		ECO Description	Project Status
C. Production equipment scheduling  D. Waste heat recovery  E. Automated production controls  Not Applicable  F. Improve facility layout  G. Solar applications  H. Consolidate process  Not Applicable  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  Low Potential Savings  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable  U. Insulation  V. Reduction of glass area  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable	Α.	Production equipment changes No	t Applicable
D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate process  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  Radiant heating  G. Loading dock seals  R. Thermal energy storage  Not Applicable  Low Potential Savings  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  Not Applicable  U. Insulation  V. Reduction of glass area  Not Applicable  Low Potential Savings  V. Reduction of glass area  Not Applicable  Low Potential Savings	В.	Efficient motors & var. speed drive No	Applicable
E. Automated production controls  Not Applicable  F. Improve facility layout  G. Solar applications  H. Consolidate process  Not Applicable  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  M. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  M. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable  Low Potential Savings  V. Reduction of glass area  Not Applicable  Low Potential Savings  V. Reduction of glass area  Not Applicable  Low Potential Savings	С.	Production equipment scheduling No	Applicable
F. Improve facility layout  G. Solar applications  H. Consolidate process  Not Applicable  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  R. Radiant heating  G. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  Low Potential Savings  V. Reduction of glass area  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable	D.	Waste heat recovery No	Applicable
G. Solar applications  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  P. Radiant heating  M. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  V. Reduction of glass area  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable	E.	Automated production controls No	t Applicable
H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  Low Potential Savings  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable  Low Potential Savings  V. Reduction of glass area  Not Applicable  Low Potential Savings  V. Reduction of glass area  Not Applicable  Low Potential Savings	F.	Improve facility layout No	t Applicable
I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  Low Potential Savings  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  Low Potential Savings  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable  W. Cargo door strip curtains  Low Potential Savings	G.	Solar applications Lo	w Potential Savings
J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  M. Lighting systems  Not Applicable  D. Electrical distribution  P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  W. Cargo door strip curtains  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings	н.	Consolidate process No	t Applicable
K. Improved methods/controls  Low Potential Savings  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Low Potential Savings  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable  U. Cargo door strip curtains  Low Potential Savings  Not Applicable  Low Potential Savings	I.	Building ventilation systems Lo	w Potential Savings
L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  G. Loading dock seals  Low Potential Savings  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable  U. Cargo door strip curtains  Low Potential Savings  Not Applicable  Low Potential Savings	J.	Production equipment maintenance No	t Applicable
M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Low Potential Savings  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable  W. Cargo door strip curtains  Low Potential Savings  Not Applicable	κ.	Improved methods/controls Lo	w Potential Savings
N. Lighting systems  C. Electrical distribution  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Low Potential Savings  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable  U. Cargo door strip curtains  Low Potential Savings  Low Potential Savings	L.	Steam/condensate distribution No	t Applicable
O. Electrical distribution Not Applicable  P. Radiant heating Not Applicable  Q. Loading dock seals Low Potential Savings  R. Thermal energy storage Not Applicable  S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Low Potential Savings  V. Reduction of glass area Not Applicable  W. Cargo door strip curtains Low Potential Savings	M.	Compressed air systems No	t Applicable
P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings  Low Potential Savings  Low Potential Savings	N.	Lighting systems EC	O Analysis Performed
Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable  Low Potential Savings  V. Reduction of glass area  Not Applicable  Low Potential Savings	ο.	Electrical distribution No	t Applicable
R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable  Not Applicable  Low Potential Savings  V. Reduction of glass area  Not Applicable  Low Potential Savings	Ρ.	Radiant heating No	t Applicable
S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Low Potential Savings  V. Reduction of glass area Not Applicable  W. Cargo door strip curtains Low Potential Savings	Q.	Loading dock seals Lo	w Potential Savings
T. Ventilation instead of A/C Not Applicable  U. Insulation Low Potential Savings  V. Reduction of glass area Not Applicable  W. Cargo door strip curtains Low Potential Savings	R.	Thermal energy storage No	t Applicable
U. Insulation  V. Reduction of glass area  Not Applicable  W. Cargo door strip curtains  Low Potential Savings	s.	Flue gas recirculation No	t Applicable
V. Reduction of glass area  Not Applicable  W. Cargo door strip curtains  Low Potential Savings	т.	Ventilation instead of A/C No	t Applicable
W. Cargo door strip curtains Low Potential Savings	U.	Insulation Lo	w Potential Savings
	٧.	Reduction of glass area No	t Applicable
X. Other applicable ECO's Not Applicable	W.	Cargo door strip curtains Lo	w Potential Savings
	х.	Other applicable ECO's No	t Applicable

AREA: Green A-Line BUILDING NAME: Change House NUMBER: 1505

	ECO Description	Project Status
Α.	Production equipment changes	NA
В.	Efficient motors & var. speed drive	NA
c.	Production equipment scheduling	NA
D.	Waste heat recovery	NA
Ε.	Automated production controls	NA
F.	Improve facility layout	NA .
G.	Solar applications	NA
н.	Consolidate process	NA
ī.	Building ventilation systems	NA
J.	Production equipment maintenance	NA
ĸ.	Improved methods/controls	NA
L.	Steam/condensate distribution	NA
M.	Compressed air systems	NA
N.	Lighting systems	LPS
0.	Electrical distribution	LPS
P.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
<b>T.</b>	Ventilation instead of A/C	NA
Ū.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
Χ.	Other applicable ECOs	LPS

PRELIMINARY EVALUATION OF ECO'S		
ARE	A: FN BUILDING NAME: Open Tank A	ir Dry NUMBER: 1606-00
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	ECO Analysis Performed
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Low Potential Savings
G.	Solar applications	Low Potential Savings
н.	Consolidate process	Not Applicable
I.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
κ.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Review Previous EEAP
M.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
P.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
т.	Ventilation instead of A/C	Not Applicable
U.	Insulation	Low Potential Savings
v.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
x.	Other applicable ECO's	ECO Analysis Performed

A: SR BUILDING NAME: Solvent Reco	very NUMBER: 1611-00
ECO Description	Project Status
Production equipment changes	Low Potential Savings
Efficient motors & var. speed drive	ECO Analysis Performed
Production equipment scheduling	Not Applicable
Waste heat recovery	Low Potential Savings
Automated production controls	Not Applicable
Improve facility layout	Not Applicable
Solar applications	Low Potential Savings
Consolidate process	Not Applicable
Building ventilation systems	Not Applicable
Production equipment maintenance	Not Applicable
Improved methods/controls	Low Potential Savings
Steam/condensate distribution	Review Previous EEAP
Compressed air systems	Not Applicable
Lighting systems	ECO Analysis Performed
Electrical distribution	Not Applicable
Radiant heating	Not Applicable
Loading dock seals	Not Applicable
Thermal energy storage	Not Applicable
Flue gas recirculation	Not Applicable
Ventilation instead of A/C	Not Applicable
Insulation	Low/No Cost Project
Reduction of glass area	Not Applicable
Cargo door strip curtains	ECO Analysis Performed
Other applicable ECO's	Not Applicable
	ECO Description  Production equipment changes  Efficient motors & var. speed drive  Production equipment scheduling  Waste heat recovery  Automated production controls  Improve facility layout  Solar applications  Consolidate process  Building ventilation systems  Production equipment maintenance  Improved methods/controls  Steam/condensate distribution  Compressed air systems  Lighting systems  Electrical distribution  Radiant heating  Loading dock seals  Thermal energy storage  Flue gas recirculation  Ventilation instead of A/C  Insulation  Reduction of glass area  Cargo door strip curtains

ARE	A: FN BUILDING NAME: Water Dry	NUMBER: 1674-00
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
C.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Low Potential Savings
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Not Applicable
G.	Solar applications	Low Potential Savings
н.	Consolidate process	Not Applicable
ī.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
κ.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Review Previous EEAP
М.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Ρ.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
т.	Ventilation instead of A/C	Not Applicable
U.	Insulation	ECO Analysis Performed
٧.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
×.	Other applicable ECO's	ECO Analysis Performed

A. Production equipment changes Not Applicable B. Efficient motors & var. speed drive Not Applicable C. Production equipment scheduling Not Applicable D. Waste heat recovery Not Applicable E. Automated production controls Not Applicable F. Improve facility layout Not Applicable G. Solar applications Not Applicable H. Consolidate processes Not Applicable I. Building ventilation systems Not Applicable J. Production equipment maintenance Not Applicable K. Improved methods/controls Not Applicable	
B. Efficient motors & var. speed drive Not Applicable C. Production equipment scheduling Not Applicable D. Waste heat recovery Not Applicable E. Automated production controls Not Applicable F. Improve facility layout Not Applicable G. Solar applications Not Applicable H. Consolidate processes Not Applicable I. Building ventilation systems Not Applicable J. Production equipment maintenance Not Applicable	us
C. Production equipment scheduling Not Applicable D. Waste heat recovery Not Applicable E. Automated production controls Not Applicable F. Improve facility layout Not Applicable G. Solar applications Not Applicable H. Consolidate processes Not Applicable I. Building ventilation systems Not Applicable J. Production equipment maintenance Not Applicable	
D. Waste heat recovery  E. Automated production controls  Not Applicable  F. Improve facility layout  Not Applicable  G. Solar applications  Not Applicable  H. Consolidate processes  Not Applicable  I. Building ventilation systems  Not Applicable  J. Production equipment maintenance  Not Applicable	
E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate processes  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Production equipment maintenance  Not Applicable	
F. Improve facility layout  G. Solar applications  H. Consolidate processes  Not Applicable  I. Building ventilation systems  Not Applicable  J. Production equipment maintenance  Not Applicable	
G. Solar applications  H. Consolidate processes  Not Applicable  I. Building ventilation systems  Not Applicable  J. Production equipment maintenance  Not Applicable	
H. Consolidate processes  Not Applicable  I. Building ventilation systems  Not Applicable  J. Production equipment maintenance  Not Applicable	
<ul> <li>I. Building ventilation systems Not Applicable</li> <li>J. Production equipment maintenance Not Applicable</li> </ul>	
J. Production equipment maintenance Not Applicable	
K. Improved methods/controls Not Applicable	
L. Steam/condensate distribution Not Applicable	
M. Compressed air systems Not Applicable	
N. Lighting systems Not Applicable	
O. Electrical distribution Not Applicable	
P. Radiant heating Not Applicable	
Q. Loading dock seals Not Applicable	
R. Thermal energy storage Not Applicable	
S. Flue gas recirculation Not Applicable	
T. Ventilation instead of A/C Not Applicable	
U. Insulation Not Applicable	4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 - 4 -
V. Reduction of glass area Not Applicable	
W. Cargo door strip curtains Not Applicable	
X. Other applicable ECO's Not Applicable	

ARE	A: FN BUILDING NAME: Final Blend	NUMBER: 1827-00
	ECO Description	Project Status
Α.	Production equipment changes	Not Applicable
В.	Efficient motors & var. speed drive	Not Applicable
c.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Not Applicable
E.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate processes	Not Applicable
ī.	Building ventilation systems	Not Applicable
J.	Production equipment maintenance	Not Applicable
К.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Not Applicable
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
т.	Ventilation instead of A/C	Not Applicable
U.	Insulation	Not Applicable
V.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

ARE	A: FN BUILDING NAME: Can Pack	NUMBER: 1877-00
	ECO Description	Project Status
A.	Production equipment changes	Not Applicable
В.	Efficient motors & var. speed drive	Not Applicable
c.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Not Applicable
Ε.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate processes	Not Applicable
I.	Building ventilation systems	Not Applicable
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Not Applicable
ο.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
υ.	Insulation	Not Applicable
V.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

A. Production equipment changes  B. Efficient motors & var. speed drive  Not Applicable	?
B. Efficient motors & var. speed drive Not Applicable	)
C. Production equipment scheduling Not Applicable	<del></del>
D. Waste heat recovery Not Applicable	?
E. Automated production controls Not Applicable	
F. Improve facility layout Not Applicable	?
G. Solar applications Low Potential	Savings
H. Consolidate process Not Applicable	>
I. Building ventilation systems Low Potential	Savings
J. Production equipment maintenance Not Applicable	?
K. Improved methods/controls Low Potential	Savings
L. Steam/condensate distribution Not Applicable	
M. Compressed air systems Not Applicable	?
N. Lighting systems Low Potential	Savings
O. Electrical distribution Not Applicable	?
P. Radiant heating Not Applicable	<u> </u>
Q. Loading dock seals Low Potential	Savings
R. Thermal energy storage Not Applicable	>
S. Flue gas recirculation Not Applicable	?
T. Ventilation instead of A/C Not Applicable	?
U. Insulation Low Potential	Savings
V. Reduction of glass area Low Potential	Savings
W. Cargo door strip curtains Low Potential	Savings
X. Other applicable ECO's Not Applicable	e

A. Production equipment changes  B. Efficient motors & var. speed drive  C. Production equipment scheduling  D. Waste heat recovery  E. Automated production controls  E. Automated production controls  E. Automated process  E. Solar applications  E. Consolidate process  E. Building ventilation systems  E. Improved methods/controls  E. Steam/condensate distribution  E. Steam/condensate distribution  E. Stectrical distribution  E. Compressed air systems  E. Consolidate  E. Steam/condensate distribution  E. Steam/condensate distribution  E. Steam/condensate  E. Steam/conden	ARE	A: NC BUILDING NAME: Dry House &	Conv. NUMBER: 2010-00
B. Efficient motors & var. speed drive		ECO Description	Project Status
C. Production equipment scheduling  D. Waste heat recovery  E. Automated production controls  E. Low Potential Savings  Low Potential Savings  H. Consolidate process  Low Potential Savings  I. Building ventilation systems  Low Potential Savings  J. Production equipment maintenance  Not Applicable  K. Improved methods/controls  Low Potential Savings  L. Steam/condensate distribution  Review Previous EEAP  M. Compressed air systems  Low Potential Savings  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Q. Loading dock seals  Low Potential Savings  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  Not Applicable  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  ECO Analysis Performed	Α.	Production equipment changes	Low Potential Savings
D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  M. Compressed air systems  Dow Potential Savings  Low Potential Savings  Low Potential Savings  Low Potential Savings  Low Potential Savings  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  D. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  ECO Analysis Performed  D. Low Potential Savings  Not Applicable  D. Not Applicable  Low Potential Savings  Low Potential Savings  D. Reduction of glass area  Low Potential Savings  Low Potential Savings  D. Reduction of glass area  Low Potential Savings  ECO Analysis Performed	В.	Efficient motors & var. speed drive	ECO Analysis Performed
E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  M. Compressed air systems  Low Potential Savings  Low Potential Savings  Low Potential Savings  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  Low Potential Savings  Not Applicable  V. Reduction of glass area  Low Potential Savings  Low Potential Savings  Low Potential Savings	C.	Production equipment scheduling	Not Applicable
F. Improve facility layout  G. Solar applications  H. Consolidate process  Low Potential Savings  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  N. Lighting systems  C. Electrical distribution  P. Radiant heating  G. Loading dock seals  R. Thermal energy storage  Not Applicable  T. Ventilation instead of A/C  V. Reduction of glass area  Low Potential Savings  Not Applicable  Not Applicable  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings  R. Thermal energy storage  Not Applicable  V. Reduction of glass area  Low Potential Savings	D.	Waste heat recovery	Low Potential Savings
G. Solar applications  H. Consolidate process  Low Potential Savings  I. Building ventilation systems  Low Potential Savings  J. Production equipment maintenance  K. Improved methods/controls  Low Potential Savings  L. Steam/condensate distribution  Review Previous EEAP  M. Compressed air systems  Low Potential Savings  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  G. Loading dock seals  R. Thermal energy storage  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  ECO Analysis Performed	E.	Automated production controls	Low Potential Savings
H. Consolidate process  I. Building ventilation systems  Low Potential Savings  J. Production equipment maintenance  K. Improved methods/controls  Low Potential Savings  L. Steam/condensate distribution  Review Previous EEAP  M. Compressed air systems  Low Potential Savings  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  G. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  Not Applicable  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings	F.	Improve facility layout	Not Applicable
I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  N. Lighting systems  D. Electrical distribution  P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  T. Ventilation instead of A/C  V. Reduction of glass area  Low Potential Savings  Low Potential Savings  Low Potential Savings  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Low Potential Savings  R. Thermal energy storage  Not Applicable  Low Potential Savings  Low Potential Savings	G.	Solar applications	Low Potential Savings
J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  N. Lighting systems  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  U. Reduction of glass area  Low Potential Savings  Not Applicable  Low Applicable  Dow Applicable  Low Potential Savings  Low Potential Savings  ECO Analysis Performed	н.	Consolidate process	Low Potential Savings
K. Improved methods/controls  L. Steam/condensate distribution  Review Previous EEAP  M. Compressed air systems  Low Potential Savings  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  Not Applicable  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  Low Potential Savings  Low Potential Savings  Low Potential Savings  ECO Analysis Performed	I.	Building ventilation systems	Low Potential Savings
L. Steam/condensate distribution Review Previous EEAP  M. Compressed air systems Low Potential Savings  N. Lighting systems ECO Analysis Performed  O. Electrical distribution Not Applicable  P. Radiant heating Not Applicable  Q. Loading dock seals Low Potential Savings  R. Thermal energy storage Not Applicable  S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains ECO Analysis Performed	J.	Production.equipment maintenance	Not Applicable
M. Compressed air systems  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Low Potential Savings  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  Low Potential Savings  Low Potential Savings  ECO Analysis Performed	κ.	Improved methods/controls	Low Potential Savings
N. Lighting systems  C. Electrical distribution  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  C. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  ECO Analysis Performed	L.	Steam/condensate distribution	Review Previous EEAP
O. Electrical distribution Not Applicable P. Radiant heating Not Applicable Q. Loading dock seals Low Potential Savings R. Thermal energy storage Not Applicable S. Flue gas recirculation Not Applicable T. Ventilation instead of A/C Not Applicable U. Insulation Not Applicable V. Reduction of glass area Low Potential Savings W. Cargo door strip curtains ECO Analysis Performed	M.	Compressed air systems	Low Potential Savings
P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  W. Cargo door strip curtains  Not Applicable  Low Potential Savings  ECO Analysis Performed	N.	Lighting systems	ECO Analysis Performed
Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  ECO Analysis Performed	0.	Electrical distribution	Not Applicable
R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  ECO Analysis Performed	Ρ.	Radiant heating	Not Applicable
S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains ECO Analysis Performed	Q.	Loading dock seals	Low Potential Savings
T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  ECO Analysis Performed	R.	Thermal energy storage	Not Applicable
U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  ECO Analysis Performed	s.	Flue gas recirculation	Not Applicable
V. Reduction of glass area Low Potential Savings W. Cargo door strip curtains ECO Analysis Performed	Т.	Ventilation instead of A/C	Not Applicable
W. Cargo door strip curtains ECO Analysis Performed	U.	Insulation	Not Applicable
	v.	Reduction of glass area	Low Potential Savings
X. Other applicable ECO's Not Applicable	₩.	Cargo door strip curtains	ECO Analysis Performed
	х.	Other applicable ECO's	Not Applicable

ARE	A: NC BUILDING NAME: Boiling Tub	House NUMBER: 2019-00
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
C.	Production equipment scheduling	Not Applicable
D	Waste heat recovery	Low/No Cost Project
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Not Applicable
G.	Solar applications	Low Potential Savings
н.	Consolidate process	Not Applicable
ī.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
κ.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Review Previous EEAP
M.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Ρ.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
Т.	Ventilation instead of A/C	Not Applicable
U.	Insulation	ECO Analysis Performed
v.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	ECO Analysis Performed

A: NC BUILDING NAME: Jordan Beaters	s NUMBER: 2022-00
ECO Description	Project Status
Production equipment changes	Low Potential Savings
Efficient motors & var. speed drive	ECO Analysis Performed
Production equipment scheduling	Low Potential Savings
Waste heat recovery	Not Applicable
Automated production controls	Low Potential Savings
Improve facility layout	Not Applicable
Solar applications	Not Applicable
Consolidate process	Not Applicable
Building ventilation systems	Low Potential Savings
Production equipment maintenance	Not Applicable
Improved methods/controls	Low/No Cost Project
Steam/condensate distribution	Not Applicable
Compressed air systems	Not Applicable
Lighting systems	ECO Analysis Performed
Electrical distribution	Low Potential Savings
Radiant heating	Not Applicable
Loading dock seals	Not Applicable
Thermal energy storage	Not Applicable
Flue gas recirculation	Not Applicable
Ventilation instead of A/C	Not Applicable
Insulation	Low Potential Savings
Reduction of glass area	Low Potential Savings
Cargo door strip curtains	Not Applicable
Other applicable ECO's	Not Applicable
	ECO Description  Production equipment changes  Efficient motors & var. speed drive  Production equipment scheduling  Waste heat recovery  Automated production controls  Improve facility layout  Solar applications  Consolidate process  Building ventilation systems  Production equipment maintenance  Improved methods/controls  Steam/condensate distribution  Compressed air systems  Lighting systems  Electrical distribution  Radiant heating  Loading dock seals  Thermal energy storage  Flue gas recirculation  Ventilation instead of A/C  Insulation  Reduction of glass area  Cargo door strip curtains

BUILDING NAME: Poacher & Blend. NUMBER: 2024-00 AREA: NC Project Status ECO Description Low Potential Savings Production equipment changes ECO Analysis Performed Efficient motors & var. speed drive B. Low Potential Savings Production equipment scheduling ECO Analysis Performed Waste heat recovery D. Automated production controls Low Potential Savings E. Improve facility layout Not Applicable F. Low Potential Savings Solar applications G. Low Potential Savings Consolidate process Η. Low Potential Savings Building ventilation systems I. Not Applicable Production equipment maintenance J. Not Applicable Improved methods/controls Κ. Review Previous EEAP Steam/condensate distribution Not Applicable Compressed air systems Μ. ECO Analysis Performed N. Lighting systems Electrical distribution Not Applicable 0. Not Applicable Radiant heating Not Applicable Q. Loading dock seals Thermal energy storage Not Applicable R. Not Applicable Flue gas recirculation S. Not Applicable Τ. Ventilation instead of A/C ECO Analysis Performed Insulation U. Low Potential Savings Reduction of glass area Not Applicable Cargo door strip curtains W. Not Applicable Other applicable ECO's Х.

ARE	A: <u>NC</u> BUILDING NAME: <u>Final Wringe</u>	NUMBER: 2026-00
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Not Applicable
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate process	Not Applicable
Ι.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
κ.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Review Previous EEAP
М.	Compressed air systems	Not Applicable
Ν.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
υ.	Insulation	Not Applicable
٧.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	ECO Analysis Performed
х.	Other applicable ECO's	Not Applicable

ARE	A: <u>NC</u> BUILDING NAME: <u>Dehy Press</u> H	louse NUMBER: 2500-00
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
C.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Not Applicable
E.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate process	Not Applicable
I.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
ĸ.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Review Previous EEAP
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Not Applicable
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
۵.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
Т.	Ventilation instead of A/C	Not Applicable
U.	Insulation	Not Applicable
٧.	Reduction of glass area	Low Potential Savings
₩.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

ARE	A: NC BUILDING NAME: Dip. Mix Hou	se NUMBER: 2506-00
	ECO Description	Project Status
A.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Low Potential Savings
Ε.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate processes	Not Applicable
ī.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
К.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Low Potential Savings
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Low Potential Savings
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
U.	Insulation	Not Applicable
V.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

ARE	A: <u>NC</u> BUILDING NAME: <u>Mix House</u>	NUMBER: 2508-00
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Not Applicable
Ε.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Low Potential Savings
G.	Solar applications	Not Applicable
н.	Consolidate process	Not Applicable
I.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Low Potential Savings
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
Τ.	Ventilation instead of A/C	Not Applicable
U.	Insulation	Not Applicable
٧.	Reduction of glass area	Not Applicable
W	Cargo door strip curtains	Not Applicable
x.	Other applicable ECO's	Not Applicable

ARE	A: NC BUILDING NAME: Block House	NUMBER: 2510-00
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Not Applicable
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate process	Low Potential Savings
ī.	Building ventilation systems	Not Applicable
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Review Previous EEAP
M.	Compressed air systems	Not Applicable
N.	Lighting systems	Low Potential Savings
0.	Electrical distribution	Not Applicable
P.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
Τ.	Ventilation instead of A/C	Not Applicable
υ.	Insulation	Not Applicable
٧.	Reduction of glass area	Low Potential Savings
W -	Cargo door strip curtains	Low Potential Savings
x.	Other applicable ECO's	Not Applicable

Finishing Press
BUILDING NAME: & Cut House NUMBER: 2516 AREA: Green B-Line

	ECO Description	Project Status
Α.	Production equipment changes	LPS
В.	Efficient motors & var. speed drive	LPS
c.	Production equipment scheduling	LPS
D.	Waste heat recovery	LPS
Ε.	Automated production controls	LPS
F.	Improve facility layout	LPS
G.	Solar applications	NA
Н.	Consolidate process	NA
ī.	Building ventilation systems	LPS
J.	Production equipment maintenance	LPS
K.	Improved methods/controls	LPS
L.	Steam/condensate distribution	LPS
M.	Compressed air systems	NA
N.	Lighting systems	LPS
0.	Electrical distribution	LPS
P.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
Τ.	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
Χ.	Other applicable ECOs	LPS

ARE	A: NC BUILDING NAME: Hydr. Pump H	ouse NUMBER: 2521-00
	ECO Description	Project Status
A.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	Not Applicable
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Low Potential Savings
E.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate processes	Not Applicable
ī.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
ĸ.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Review Previous EEAP
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Low Potential Savings
0.	Electrical distribution	Low Potential Savings
Ρ.	Radiant heating	Low Potential Savings
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
U.	Insulation	Low Potential Savings
٧.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	Not Applicable
x.	Other applicable ECO's	Low/No Cost Project

ARE	A: NC BUILDING NAME: A.C. Vapor	Recov. NUMBER: 2555-00
	ECO Description	Project Status
Α.	Production equipment changes	Not Applicable
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Low Potential Savings
E.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate process	Not Applicable
I.	Building ventilation systems	ECO Analysis Performed
J.	Production equipment maintenance	Not Applicable
κ.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Review Previous EEAP
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Low Potential Savings
0.	Electrical distribution	Not Applicable
Ρ.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
Т.	Ventilation instead of A/C	Not Applicable
υ.	Insulation	Low Potential Savings
v.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	Not Applicable
×.	Other applicable ECO's	Not Applicable

AREA: C-Line BUILDING NAME: Cutting and Press NUMBER: 3513

	ECO Description	Project Sta	tus
Α.	Production equipment changes	LPS	
В.	Efficient motors & var. speed drive	ECO	
c.	Production equipment scheduling	LPS	
D.	Waste heat recovery	LPS	
Ε.	Automated production controls	LPS	
F.	Improve facility layout	LPS	
G.	Solar applications	NA	
н.	Consolidate process	NA	
ī.	Building ventilation systems	LPS	
J.	Production equipment maintenance	LPS	
Κ.	Improved methods/controls	LPS	
L.	Steam/condensate distribution	LPS	
M.	Compressed air systems	NA	
N.	Lighting systems	ECO	
0.	Electrical distribution	LPS	
P.	Radiant heating	LPS	
Q.	Loading dock seals	NA	
R.	Thermal energy storage	NA	
s.	Flue gas recirculation	NA	
T.	Ventilation instead of A/C	NA	
U.	Insulation	LPS	
٧.	Reduction of glass area	LPS	
W.	Cargo door strip curtains	ECO	
X.	Other applicable ECOs	LPS	

AREA: N6 BUILDING NAME: Premix House NUMBER: 3647

		Duningt Chatus
	ECO Description	Project Status
A.	Production equipment changes	LPS
В.	Efficient motors & var. speed drive	ECO
C.	Production equipment scheduling	LPS
D.	Waste heat recovery	LPS
Ε.	Automated production controls	LPS
F.	Improve facility layout	LPS
G.	Solar applications	NA
н.	Consolidate process	LPS
ī.	Building ventilation systems	LPS
J.	Production equipment maintenance	LPS
<b>K.</b> -	Improved methods/controls	LPS
L.	Steam/condensate distribution	LPS
M.	Compressed air systems	NA
N.	Lighting systems	ECO
0.	Electrical distribution	LPS
P.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
T.	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
χ.	Other applicable ECOs	LPS

ARE	A: <u>GP</u> BUILDING NAME: <u>Power House</u>	# 2 NUMBER: 4329-00
	ECO Description	Project Status
Α.	Production equipment changes	Not Applicable
В.	Efficient motors & var. speed drive	Not Applicable
c.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Not Applicable
Ε.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate processes	Not Applicable
I.	Building ventilation systems	Not Applicable
J.	Production equipment maintenance	Not Applicable
Κ.	Improved methods/controls	Low/No Cost Project
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Not Applicable
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
υ.	Insulation	Not Applicable
v.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

A: <u>GP</u> BUILDING NAME: <u>Inert Gas Hou</u>	ıse	NUMBER: 4903-00
ECO Description		Project Status
Production equipment changes	Not	Applicable
Efficient motors & var. speed drive	Not	Applicable
Production equipment scheduling	Not	Applicable
Waste heat recovery	Not	Applicable
Automated production controls	Not	Applicable
Improve facility layout	Not	Applicable
Solar applications	Not	Applicable
Consolidate processes	Not	Applicable
Building ventilation systems	Not	Applicable
Production equipment maintenance	Not	Applicable
Improved methods/controls	Not	Applicable
Steam/condensate distribution	Not	Applicable
Compressed air systems	Not	Applicable
Lighting systems	Not	Applicable
Electrical distribution	Not	Applicable
Radiant heating	Not	Applicable
Loading dock seals	Not	Applicable
Thermal energy storage	Not	Applicable
Flue gas recirculation	Not	Applicable
Ventilation instead of A/C	Not	Applicable
Insulation	Not	Applicable
Reduction of glass area	Not	Applicable
Cargo door strip curtains	Not	Applicable
Other applicable ECO's	Not	Applicable
	Production equipment changes Efficient motors & var. speed drive Production equipment scheduling Waste heat recovery Automated production controls Improve facility layout Solar applications Consolidate processes Building ventilation systems Production equipment maintenance Improved methods/controls Steam/condensate distribution Compressed air systems Lighting systems Electrical distribution Radiant heating Loading dock seals Thermal energy storage Flue gas recirculation Ventilation instead of A/C Insulation Reduction of glass area Cargo door strip curtains	Production equipment changes Not Efficient motors & var. speed drive Not Production equipment scheduling Not Waste heat recovery Not Automated production controls Not Improve facility layout Not Solar applications Not Consolidate processes Not Building ventilation systems Not Production equipment maintenance Not Improved methods/controls Not Steam/condensate distribution Not Compressed air systems Not Lighting systems Not Electrical distribution Not Radiant heating Not Thermal energy storage Not Flue gas recirculation Not Ventilation instead of A/C Not Insulation Not Reduction of glass area Not Cargo door strip curtains

ARE	A: NC BUILDING NAME: Final Mix Ho	use NUMBER: 4906-00
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
C.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Low Potential Savings
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Not Applicable
G.	Solar applications	Low Potential Savings
н.	Consolidate process	Not Applicable
ī.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
κ.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Low Potential Savings
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Low Potential Savings
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
Т.	Ventilation instead of A/C	Not Applicable
U.	Insulation	Not Applicable
v.	Reduction of glass area	Low Potential Savings
W .	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

ARE	A: NC BUILDING NAME: Press & Cutt	ing NUMBER: 4908-00	
	ECO Description	Project Status	
Α.	Production equipment changes	Low Potential Savings	
В.	Efficient motors & var. speed drive	ECO Analysis Performed	
c.	Production equipment scheduling	Low Potential Savings	
D.	Waste heat recovery	Low Potential Savings	
Ε.	Automated production controls	Low Potential Savings	
F.	Improve facility layout	Low Potential Savings	
G.	Solar applications	Low Potential Savings	
н.	Consolidate process	Not Applicable	
ī.	Building ventilation systems	Low Potential Savings	
J.	Production equipment maintenance	Not Applicable	
κ.	Improved methods/controls	Low Potential Savings	
L.	Steam/condensate distribution	Low Potential Savings	
М.	Compressed air systems	Not Applicable	
N.	Lighting systems	Low Potential Savings	
0.	Electrical distribution	Not Applicable	
Ρ.	Radiant heating	Not Applicable	
Q.	Loading dock seals	Not Applicable	
R.	Thermal energy storage	Not Applicable	
s.	Flue gas recirculation	Not Applicable	
т.	Ventilation instead of A/C	Not Applicable	
U.	Insulation	Low/No Cost Project	
v.	Reduction of glass area	Low Potential Savings	
W .	Cargo door strip curtains	Not Applicable	
х.	Other applicable ECO's	Not Applicable	

ARE	A: <u>RK</u> BUILDING NAME: <u>Saw &amp; Inhibi</u>	ting NUMBER: 4912-03
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Low Potential Savings
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Not Applicable
G.	Solar applications	Low Potential Savings
н.	Consolidate processes	Not Applicable
ī.	Building ventilation systems ·	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Low Potential Savings
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
Т.	Ventilation instead of A/C	Low Potential Savings
U.	Insulation	Low/No Cost Project
٧.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	Not Applicable
×.	Other applicable ECO's	Not Applicable

NUMBER: 4912-04 AREA: RK BUILDING NAME: Saw & Inhibiting Project Status ECO Description Low Potential Savings Production equipment changes ECO Analysis Performed Efficient motors & var. speed drive В. Low Potential Savings С. Production equipment scheduling Low Potential Savings Waste heat recovery D. Low Potential Savings Automated production controls E. Improve facility layout Not Applicable F. Low Potential Savings Solar applications G. Consolidate processes Not Applicable Η. Building ventilation systems Low Potential Savings I. Not Applicable J. Production equipment maintenance Improved methods/controls Low Potential Savings Κ. Not Applicable Steam/condensate distribution L. Low Potential Savings Compressed air systems Μ. ECO Analysis Performed Lighting systems N. Electrical distribution Not Applicable Ο. Not Applicable Ρ. Radiant heating Not Applicable Loading dock seals Q. R. Thermal energy storage Low Potential Savings Not Applicable Flue gas recirculation S. Ventilation instead of A/C Low Potential Savings Τ. Insulation Not Applicable U. Low Potential Savings Reduction of glass area V. Cargo door strip curtains Not Applicable W. Other applicable ECO's Not Applicable Χ.

ARE	AREA: RK BUILDING NAME: Pin Assembly NUMBER: 4912-07			
	ECO Description	Project Status		
Α.	Production equipment changes	Low Potential Savings		
В.	Efficient motors & var. speed drive	ECO Analysis Performed		
C.	Production equipment scheduling	Not Applicable		
D.	Waste heat recovery	Low Potential Savings		
E.	Automated production controls	Low Potential Savings		
F.	Improve facility layout	Low Potential Savings		
G.	Solar applications	Low Potential Savings		
н.	Consolidate process	Not Applicable		
ī.	Building ventilation systems	Low Potential Savings		
J.	Production equipment maintenance	Not Applicable		
κ.	Improved methods/controls	Low Potential Savings		
L.	Steam/condensate distribution	Low/No Cost Project		
M.	Compressed air systems	Not Applicable		
N.	Lighting systems	ECO Analysis Performed		
0.	Electrical distribution	Not Applicable		
Ρ.	Radiant heating	Not Applicable		
Q.	Loading dock seals	Not Applicable		
R.	Thermal energy storage	Low Potential Savings		
s.	Flue gas recirculation	Not Applicable		
Т.	Ventilation instead of A/C	ECO Analysis Performed		
U.	Insulation	Low/No Cost Project		
٧.	Reduction of glass area	Low Potential Savings		
W.	Cargo door strip curtains	Not Applicable		
х.	Other applicable ECO's	Not Applicable		

ARE	A: <u>RK</u> BUILDING NAME: <u>Mold Loading</u>	NUMBER: 4912-11
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Low Potential Savings
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Not Applicable
G.	Solar applications	Low Potential Savings
н.	Consolidate processes	Not Applicable
ī.	Building ventilation systems	Low/No Cost Project
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Not Applicable .
М.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Ρ.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Low Potential Savings
U.	Insulation	Low/No Cost Project
v.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

ARE	A: <u>RK</u> BUILDING NAME: <u>Spiral Wrap</u>	NUMBER: 4912-15
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
C.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Low Potential Savings
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Low Potential Savings
G.	Solar applications	Low Potential Savings
н.	Consolidate process	Not Applicable
Ι.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
Т.	Ventilation instead of A/C	Low Potential Savings
U.	Insulation	Not Applicable
٧.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

ARE	A: <u>RK</u> BUILDING NAME: <u>Curing House</u>	NUMBER: 4912-27
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Not Applicable
Ε.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Not Applicable
G.	Solar applications	Low Potential Savings
н.	Consolidate processes	Low Potential Savings
ī.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	`Not Applicable
M.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
ο.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
۵.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
т.	Ventilation instead of A/C	Not Applicable
U.	Insulation	Not Applicable
٧.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	ECO Analysis Performed

A. Production equipment changes  B. Efficient motors & var. speed drive  C. Production equipment scheduling  D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  C. Solar applications  H. Consolidate process  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  Low Potential Savings  J. Steam/condensate distribution  M. Compressed air systems  Not Applicable  P. Radiant heating  Not Applicable  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  Not Applicable  U. Insulation  Not Applicable  V. Reduction of glass area  Not Applicable  V. Reduction of glass area  Not Applicable  X. Other applicable ECO's  ECO Analysis Performed	ARE	A: MF BUILDING NAME: Forced Air	Dry	NUMBER: 4912-34
B. Efficient motors & var. speed drive	,	ECO Description		Project Status
C. Production equipment scheduling  D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate process  H. Consolidate process  Not Applicable  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  Low Potential Savings  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  M. Lighting systems  C. Electrical distribution  P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  Not Applicable   Α.	Production equipment changes	Not	Applicable	
D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate process  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  P. Radiant heating  G. Loading dock seals  R. Thermal energy storage  Not Applicable	В.	Efficient motors & var. speed drive	ECO	Analysis Performed
E. Automated production controls  Not Applicable  F. Improve facility layout  Not Applicable  G. Solar applications  H. Consolidate process  Not Applicable  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  M. Lighting systems  C. Electrical distribution  P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  Not Applicable	c.	Production equipment scheduling	Not	Applicable
F. Improve facility layout  G. Solar applications  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  R. ECO Analysis Performed  G. Electrical distribution  P. Radiant heating  G. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  W. Reduction of glass area  Not Applicable	D.	Waste heat recovery	Not	Applicable
G. Solar applications  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  P. Radiant heating  G. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  V. Reduction of glass area  Not Applicable	E.	Automated production controls	Not	Applicable
H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  M. Loading dock seals  R. Thermal energy storage  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  Not Applicable  V. Reduction of glass area  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Not Applicable	F.	Improve facility layout	Not	Applicable
I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Not Applicable  W. Cargo door strip curtains  Not Applicable  Not Applicable	G.	Solar applications	Low	Potential Savings
J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Not Applicable	н.	Consolidate process	Not	Applicable
K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  M. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Not Applicable  W. Cargo door strip curtains  Not Applicable  Not Applicable	Ι.	Building ventilation systems	Low	Potential Savings
L. Steam/condensate distribution Not Applicable  M. Compressed air systems Not Applicable  N. Lighting systems ECO Analysis Performed  O. Electrical distribution Not Applicable  P. Radiant heating Not Applicable  G. Loading dock seals Not Applicable  R. Thermal energy storage Not Applicable  S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Not Applicable  W. Cargo door strip curtains Not Applicable	J.	Production equipment maintenance	Not	Applicable
M. Compressed air systems  Not Applicable  ECO Analysis Performed  D. Electrical distribution  P. Radiant heating  O. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable	к.	Improved methods/controls	Low	Potential Savings
N. Lighting systems  C. Electrical distribution  P. Radiant heating  Not Applicable  O. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Not Applicable	L.	Steam/condensate distribution	Not	Applicable
O. Electrical distribution Not Applicable  P. Radiant heating Not Applicable  G. Loading dock seals Not Applicable  R. Thermal energy storage Not Applicable  S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Not Applicable  W. Cargo door strip curtains Not Applicable	М.	Compressed air systems	Not	Applicable
P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Not Applicable	N.	Lighting systems	ECO	Analysis Performed
Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Not Applicable  W. Cargo door strip curtains  Not Applicable	0.	Electrical distribution	Not	Applicable
R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Not Applicable  W. Cargo door strip curtains  Not Applicable	Р.	Radiant heating	Not	Applicable
S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Not Applicable  W. Cargo door strip curtains Not Applicable	Q.	Loading dock seals	Not	Applicable
T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Not Applicable  W. Cargo door strip curtains Not Applicable	R.	Thermal energy storage	Not	Applicable
U. Insulation Not Applicable  V. Reduction of glass area Not Applicable  W. Cargo door strip curtains Not Applicable	s.	Flue gas recirculation	Not	Applicable
V. Reduction of glass area  Not Applicable  W. Cargo door strip curtains  Not Applicable	Т.	Ventilation instead of A/C	Not	Applicable
W. Cargo door strip curtains Not Applicable	U.	Insulation	Not	Applicable
	v.	Reduction of glass area	Not	Applicable
X. Other applicable ECO's ECO Analysis Performed	W.	Cargo door strip curtains	Not	Applicable
	х.	Other applicable ECO's	ECO	Analysis Performed

ARE	A: MF BUILDING NAME: Forced Air D	ry NUMBER: 4912-40
	ECO Description	Project Status
Α.	Production equipment changes	Not Applicable
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Not Applicable
E.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Low Potential Savings
н.	Consolidate processes	Not Applicable
ī.	Building ventilation systems	Review Previous EEAP
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Low/No Cost Project
М.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
υ.	Insulation	Low/No Cost Project
٧.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	ECO Analysis Performed

A. Production equipment changes  B. Efficient motors & var. speed drive  C. Production equipment scheduling  D. Waste heat recovery  E. Automated production controls  E. Automated production controls  E. Automated processes  C. Solar applications  E. Consolidate processes  E. Dow Potential Savings  E. Building ventilation systems  E. Building ventilation systems  E. Mot Applicable  E. Timprove facility layout  E. Ow Potential Savings  E. We Potential Savings  E. We Potential Savings  E. We Potential Savings  E. We Potential Savings  E. We Potential Savings  E. We Potential Savings  E. We Potential Savings  E. We Potential Savings  E. We Potential Savings  E. We Potential Savings  E. We Potential Savings  E. We Potential Savings  E. Applicable  E. Steam/condensate distribution  M. Compressed air systems  E. Conalysis Performed  E. Low/No Cost Project  E. Lighting systems  E. Conalysis Performed  E. Low Applicable  E. Automated production and Applicable  E. Radiant heating  E. Not Applicable  E. Thermal energy storage  E. Not Applicable  E. Flue gas recirculation  E. Ventilation instead of A/C  E. Not Applicable  E. We Potential Savings  E. Corgo door strip curtains  E. Not Applicable  E. We Applicable  E. Automated professed and Applicable  E. Aut	AREA: RK BUILDING NAME: Mold Assembly		NUMBER: 4915-00
B. Efficient motors & var. speed drive		ECO Description	Project Status
C. Production equipment scheduling  D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate processes  Low Potential Savings  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Low/No Cost Project  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  R. Applicable  Not Applicable  Low Potential Savings  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	Α.	Production equipment changes	Low Potential Savings
D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate processes  Low Potential Savings  H. Consolidate processes  Low Potential Savings  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Low/No Cost Project  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	В.	Efficient motors & var. speed drive	ECO Analysis Performed
E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate processes  Low Potential Savings  H. Consolidate processes  Low Potential Savings  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  Mot Applicable  K. Improved methods/controls  Mot Applicable  M. Compressed air systems  Low/No Cost Project  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  Not Applicable  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	c.	Production equipment scheduling	Not Applicable
F. Improve facility layout  G. Solar applications  H. Consolidate processes  Low Potential Savings  H. Consolidate processes  Low Potential Savings  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Low/No Cost Project  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	D.	Waste heat recovery	Not Applicable
G. Solar applications  H. Consolidate processes  Low Potential Savings  I. Building ventilation systems  Low Potential Savings  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Low/No Cost Project  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  R. Radiant heating  Not Applicable  R. Thermal energy storage  Not Applicable  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	Ε.	Automated production controls	Not Applicable
H. Consolidate processes  I. Building ventilation systems  Low Potential Savings  J. Production equipment maintenance  K. Improved methods/controls  Not Applicable  K. Steam/condensate distribution  M. Compressed air systems  Low/No Cost Project  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	F.	Improve facility layout	Low Potential Savings
I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Low/No Cost Project  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	G.	Solar applications	Low Potential Savings
J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Low/No Cost Project  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	н.	Consolidate processes	Low Potential Savings
K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Low/No Cost Project  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	I.	Building ventilation systems	Low Potential Savings
L. Steam/condensate distribution  M. Compressed air systems  Low/No Cost Project  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  Not Applicable  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  Not Applicable  U. Insulation  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	J.	Production equipment maintenance	Not Applicable
M. Compressed air systems  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  R. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  W. Cargo door strip curtains  Low/No Cost Project  ECO Analysis Performed  ECO Analysis Performed  Not Applicable  Not Applicable  Low Potential Savings  Not Applicable	κ.	Improved methods/controls	Not Applicable
N. Lighting systems  C. Electrical distribution  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  W. Cargo door strip curtains  ECO Analysis Performed  Not Applicable  Not Applicable  Not Applicable  Low Potential Savings  Not Applicable	L.	Steam/condensate distribution	Not Applicable `
O. Electrical distribution Not Applicable P. Radiant heating Not Applicable Q. Loading dock seals Not Applicable R. Thermal energy storage Not Applicable S. Flue gas recirculation Not Applicable T. Ventilation instead of A/C Not Applicable U. Insulation Low Potential Savings V. Reduction of glass area Low Potential Savings W. Cargo door strip curtains Not Applicable	М.	Compressed air systems	Low/No Cost Project
P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  W. Cargo door strip curtains  Not Applicable  Low Potential Savings  Not Applicable	N.	Lighting systems	ECO Analysis Performed
Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	0.	Electrical distribution	Not Applicable
Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Low Potential Savings  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	Р.	Radiant heating	Not Applicable
S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Low Potential Savings  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	Q.	Loading dock seals	Not Applicable
T. Ventilation instead of A/C Not Applicable  U. Insulation Low Potential Savings  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	R.	Thermal energy storage	Not Applicable
U. Insulation  V. Reduction of glass area  Low Potential Savings  Low Potential Savings  Not Applicable	s.	Flue gas recirculation	Not Applicable
V. Reduction of glass area Low Potential Savings W. Cargo door strip curtains Not Applicable	Т.	Ventilation instead of A/C	Not Applicable
W. Cargo door strip curtains Not Applicable	U.	Insulation	Low Potential Savings
	v.	Reduction of glass area	Low Potential Savings
X. Other applicable ECO's Not Applicable	₩.	Cargo door strip curtains	Not Applicable
	x.	Other applicable ECO's	Not Applicable

AREA: RK BUILDING NAME: Dessicator	Insp. NUMBER: 4921-00
ECO Description	Project Status
A. Production equipment changes	Not Applicable
B. Efficient motors & var. speed drive	ECO Analysis Performed
C. Production equipment scheduling	Not Applicable
D. Waste heat recovery	Not Applicable
E. Automated production controls	Not Applicable
F. Improve facility layout .	Low Potential Savings
G. Solar applications	Low Potential Savings
H. Consolidate processes	Not Applicable
I. Building ventilation systems	Low Potential Savings
J. Production equipment maintenance	Not Applicable
K. Improved methods/controls	Not Applicable
L. Steam/condensate distribution	Not Applicable
M. Compressed air systems	Not Applicable
N. Lighting systems	ECO Analysis Performed
O. Electrical distribution	Not Applicable
P. Radiant heating	Not Applicable
Q. Loading dock seals	Not Applicable
R. Thermal energy storage	Not Applicable
S. Flue gas recirculation	Not Applicable
T. Ventilation instead of A/C	Not Applicable
U. Insulation	Low Potential Savings
V. Reduction of glass area	Low Potential Savings
W. Cargo door strip curtains	Not Applicable
X. Other applicable ECO's	Not Applicable

ARE	A: RK BUILDING NAME: Motor Load	House NUMBER: 4924-01
	ECO Description	Project Status
Α.	Production equipment changes	Not Applicable
В.	Efficient motors & var. speed drive	ECO Analysis Performed
C.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Low Potential Savings
E.	Automated production controls	Not Applicable
F.	Improve facility layout	Low Potential Savings
G.	Solar applications	Low Potential Savings
н.	Consolidate processes	Not Applicable
I.	Building ventilation systems	Low/No Cost Project
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution .	Low/No Cost Project
М.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Ρ.	Radiant heating	Not Applicable
Q.	Loading dock seals	Low Potential Savings
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
Т.	Ventilation instead of A/C	Low Potential Savings
U.	Insulation	Low Potential Savings
v.	Reduction of glass area	Low Potential Savings
W .	Cargo door strip curtains	Low Potential Savings
×.	Other applicable ECO's	Not Applicable
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A. Production equipment changes B. Efficient motors & var. speed drive C. Production equipment scheduling C. Production equipment scheduling D. Waste heat recovery D. Waste heat recovery Not Applicable E. Automated production controls C. Solar applications D. Waste heat recovery Not Applicable C. Solar applications D. Waste heat recovery Not Applicable C. Solar applications D. Waste heat recovery Not Applicable C. Solar applications D. Waste heat recovery Not Applicable C. Solar applications D. Waste heat recovery Not Applicable C. Solar applications D. Applicable C. Supplicable C. Supplicable C. Supplicable C. Steam/condensate distribution D. Compressed air systems D. Applicable D. Lighting systems D. Electrical distribution D. Compressed air systems D. Electrical distribution D. Complicable C. Radiant heating D. Loading dock seals D. Not Applicable C. Low Potential Savings D. Flue gas recirculation D. Not Applicable D. Ventilation instead of A/C D. Low Potential Savings D. Reduction of glass area D. Wedential Savings D. Reduction of glass area D. Wedential Savings D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable D. Reduction of glass area D. Wot Applicable	ARE	A: <u>RK</u> BUILDING NAME: <u>Dowel Rod</u>	NUMBER: 4924-05
B. Efficient motors & var. speed drive   C. Production equipment scheduling   D. Waste heat recovery   E. Automated production controls   E. Dow Potential Savings   E. Solar applications   E. Not Applicable   E. Suilding ventilation systems   E. Dow Potential Savings   E. Dow Potential Savings   E. Improved methods/controls   E. Steam/condensate distribution   E. O. Applicable   E. O. Analysis Performed   E. O. Applicable	ECO Description	Project Status	
C. Production equipment scheduling  D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  R. Radiant heating  G. Loading dock seals  R. Thermal energy storage  Not Applicable  Low Potential Savings  Not Applicable  R. Thermal energy storage  Low Potential Savings  S. Flue gas recirculation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	Α.	Production equipment changes	Low Potential Savings
D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  D. Electrical distribution  P. Radiant heating  G. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  V. Reduction of glass area  W. Cargo door strip curtains  Not Applicable  Low Potential Savings  W. Cargo door strip curtains  Not Applicable  Low Potential Savings  Low Potential Savings	В.	Efficient motors & var. speed drive	ECO Analysis Performed
E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	С.	Production equipment scheduling	Low Potential Savings
F. Improve facility layout  G. Solar applications  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  P. Radiant heating  G. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  V. Reduction of glass area  W. Cargo door strip curtains  Not Applicable  Not Applicable  Low Potential Savings  U. Reduction of glass area  Not Applicable  Low Potential Savings	D.	Waste heat recovery	Not Applicable
G. Solar applications  H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  P. Radiant heating  Not Applicable  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Not Applicable  Low Potential Savings  U. Reduction of glass area  Low Potential Savings  Not Applicable	E.	Automated production controls	Low Potential Savings
H. Consolidate process  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  G. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	F.	Improve facility layout	Not Applicable
I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  W. Cargo door strip curtains  Low Potential Savings  Not Applicable  V. Reduction of glass area  Low Potential Savings  Not Applicable	G.	Solar applications	Not Applicable
J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  W. Cargo door strip curtains  Not Applicable  Low Potential Savings  Not Applicable	н.	Consolidate process	Not Applicable
K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  Not Applicable  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	ī.	Building ventilation systems	Low Potential Savings
L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  G. Loading dock seals  Not Applicable  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	J.	Production equipment maintenance	Not Applicable
M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  R. Loading dock seals  Not Applicable  R. Thermal energy storage  Low Potential Savings  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	к.	Improved methods/controls	Not Applicable
N. Lighting systems  C. Electrical distribution  P. Radiant heating  C. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  Low Potential Savings  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable  V. Reduction of glass area  Not Applicable	L.	Steam/condensate distribution	Not Applicable
O. Electrical distribution Not Applicable  P. Radiant heating Not Applicable  Q. Loading dock seals Not Applicable  R. Thermal energy storage Low Potential Savings  S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Low Potential Savings  U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	M.	Compressed air systems	Not Applicable
P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  W. Cargo door strip curtains  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable	N.	Lighting systems	ECO Analysis Performed
Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Not Applicable  Low Potential Savings  Not Applicable  V. Reduction of glass area  Not Applicable	0.	Electrical distribution	Not Applicable
R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  W. Cargo door strip curtains  Low Potential Savings  Not Applicable  Not Applicable	Р.	Radiant heating	Not Applicable
R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  W. Cargo door strip curtains  Low Potential Savings  Not Applicable	Q.	Loading dock seals	Not Applicable
T. Ventilation instead of A/C Low Potential Savings  U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	R.		Low Potential Savings
U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	s.	Flue gas recirculation	Not Applicable
V. Reduction of glass area Low Potential Savings W. Cargo door strip curtains Not Applicable	Т.	Ventilation instead of A/C	Low Potential Savings
W. Cargo door strip curtains Not Applicable	U.	Insulation	Not Applicable
	v.	Reduction of glass area	Low Potential Savings
X. Other applicable ECO's Not Applicable	W.	Cargo door strip curtains	Not Applicable
	х.	Other applicable ECO's	Not Applicable

ARE	AREA: RK BUILDING NAME: Machine & Sawing NUMBER: 4924-06			
	ECO Description	Project Status		
Α.	Production equipment changes	Low Potential Savings		
В.	Efficient motors & var. speed drive	ECO Analysis Performed		
C.	Production equipment scheduling	Low Potential Savings		
D.	Waste heat recovery	Low Potential Savings		
E.	Automated production controls	Low Potential Savings		
F.	Improve facility layout	Low Potential Savings		
G.	Solar applications	Low Potential Savings		
н.	Consolidate process	Low Potential Savings		
ī.	Building ventilation systems	Low Potential Savings		
J.	Production equipment maintenance	Not Applicable		
ĸ.	Improved methods/controls	Low Potential Savings		
L.	Steam/condensate distribution	Low/No Cost Project		
M.	Compressed air systems	Not Applicable		
N.	Lighting systems	ECO Analysis Performed		
0.	Electrical distribution	Not Applicable		
Р.	Radiant heating	Not Applicable		
Q.	Loading dock seals	Not Applicable		
R.	Thermal energy storage	Low Potential Savings		
s.	Flue gas recirculation	Not Applicable		
Т.	Ventilation instead of A/C	Low Potential Savings		
U.	Insulation	Not Applicable		
v.	Reduction of glass area	Low Potential Savings		
W.	Cargo door strip curtains	Not Applicable		
х.	Other applicable ECO's	Not Applicable		

ARE	A: <u>RK</u> BUILDING NAME: <u>Finishing Ope</u>	NUMBER: 4925-00
	ECO Description	Project Status
Α.	Production equipment changes .	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Low Potential Savings
E.	Automated production controls	Not Applicable
F.	Improve facility layout	Low Potential Savings
G.	Solar applications	Low Potential Savings
н.	Consolidate processes	Low Potential Savings
Ι.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Low Potential Savings
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
Т.	Ventilation instead of A/C	Low Potential Savings
υ.	Insulation	Low Potential Savings
٧.	Reduction of glass area	Low Potential Savings
₩.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

A. Production equipment changes B. Efficient motors & var. speed drive C. Production equipment scheduling C. Production equipment scheduling D. Waste heat recovery D. Waste heat recovery Not Applicable E. Automated production controls C. Solar applications D. Waste heat recovery Low Potential Savings Low Applicable E. Steam/condensate distribution Review Previous EEAP M. Compressed air systems Review Previous EEAP M. Lighting systems ECO Analysis Performed D. Electrical distribution Not Applicable Radiant heating Not Applicable R. Thermal energy storage Not Applicable S. Flue gas recirculation Not Applicable T. Ventilation instead of A/C Not Applicable U. Insulation Not Applicable V. Reduction of glass area Low Potential Savings W. Cargo door strip curtains Not Applicable X. Other applicable ECO's Not Applicable	ARE	A: <u>RK</u> BUILDING NAME: <u>TOW Saw Hous</u>	se NUMBER: 4951-02
B. Efficient motors & var. speed drive   C. Production equipment scheduling   D. Waste heat recovery   E. Automated production controls   E. Automated production controls   E. Automated production controls   E. Automated productions   E. Improve facility layout   E. Dow Potential Savings   E. Low Potential Savings   E. Solar applications   E. Low Potential Savings   E. Dow Potential Savings   E.		ECO Description	Project Status
C. Production equipment scheduling  D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate processes  H. Consolidate processes  Not Applicable  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  M. Compressed air systems  Not Applicable  C. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  P. Radiant heating  G. Loading dock seals  R. Thermal energy storage  Not Applicable  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  Not Applicable	Α.	Production equipment changes	Low Potential Savings
D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate processes  Not Applicable  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  M. Compressed air systems  Not Applicable  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  P. Radiant heating  O. Loading dock seals  R. Thermal energy storage  Not Applicable  Linsulation  Not Applicable  Not Applicable  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	В.	Efficient motors & var. speed drive	ECO Analysis Performed
E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate processes  Not Applicable  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  M. Compressed air systems  Not Applicable  C. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  P. Radiant heating  M. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  V. Reduction of glass area  W. Cargo door strip curtains  Low Potential Savings  Low Potential Savings  Low Potential Savings  Low Potential Savings  Not Applicable  Low Potential Savings  Low Potential Savings  Not Applicable	c.	Production equipment scheduling	Low Potential Savings
F. Improve facility layout . Low Potential Savings G. Solar applications . Low Potential Savings H. Consolidate processes . Not Applicable I. Building ventilation systems . Low Potential Savings J. Production equipment maintenance . Not Applicable K. Improved methods/controls . Not Applicable L. Steam/condensate distribution . Review Previous EEAP M. Compressed air systems . Not Applicable N. Lighting systems . ECO Analysis Performed O. Electrical distribution . Not Applicable P. Radiant heating . Not Applicable Q. Loading dock seals . Not Applicable R. Thermal energy storage . Not Applicable S. Flue gas recirculation . Not Applicable T. Ventilation instead of A/C . Not Applicable U. Insulation . Not Applicable V. Reduction of glass area . Low Potential Savings W. Cargo door strip curtains . Not Applicable	D.	Waste heat recovery	Not Applicable
G. Solar applications  H. Consolidate processes  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  C. Steam/condensate distribution  M. Compressed air systems  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Review Previous EEAP  M. Compressed air systems  Not Applicable  Not Applicable  Not Applicable  P. Radiant heating  Not Applicable  R. Thermal energy storage  Not Applicable  T. Ventilation instead of A/C  Not Applicable  V. Reduction of glass area  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable	Ε.	Automated production controls	Low Potential Savings
H. Consolidate processes  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  Not Applicable  C. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  P. Radiant heating  G. Loading dock seals  R. Thermal energy storage  Not Applicable  T. Ventilation instead of A/C  Not Applicable  V. Reduction of glass area  Not Applicable  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	F.	Improve facility layout .	Low Potential Savings
I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  Not Applicable  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	G.	Solar applications	Low Potential Savings
J. Production equipment maintenance  K. Improved methods/controls  Not Applicable  L. Steam/condensate distribution  Review Previous EEAP  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  Not Applicable  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	н.	Consolidate processes	Not Applicable
K. Improved methods/controls  L. Steam/condensate distribution  Review Previous EEAP  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	ī.	Building ventilation systems	Low Potential Savings
L. Steam/condensate distribution  Review Previous EEAP  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  Not Applicable  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  Not Applicable  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	J.	Production equipment maintenance	Not Applicable .
M. Compressed air systems  Not Applicable  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  W. Cargo door strip curtains  Not Applicable  Low Potential Savings  Not Applicable	κ.	Improved methods/controls	Not Applicable
N. Lighting systems  C. Electrical distribution  D. Electrical distribution  P. Radiant heating  O. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  W. Cargo door strip curtains  ECO Analysis Performed  Not Applicable  Not Applicable  Not Applicable  Low Potential Savings  Not Applicable	Ľ.	Steam/condensate distribution	Review Previous EEAP
O. Electrical distribution Not Applicable  P. Radiant heating Not Applicable  Q. Loading dock seals Not Applicable  R. Thermal energy storage Not Applicable  S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	М.	Compressed air systems	Not Applicable
P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  V. Reduction of glass area  W. Cargo door strip curtains  Not Applicable  Low Potential Savings  Not Applicable	N.	Lighting systems	ECO Analysis Performed
Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	0.	Electrical distribution	Not Applicable
R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	Р.	Radiant heating	Not Applicable
S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	Q.	Loading dock seals	Not Applicable
T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	R.	Thermal energy storage	Not Applicable
U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	s.	Flue gas recirculation	Not Applicable
V. Reduction of glass area Low Potential Savings W. Cargo door strip curtains Not Applicable	Т.	Ventilation instead of A/C	Not Applicable
W. Cargo door strip curtains Not Applicable	U.	Insulation	Not Applicable
	v.	Reduction of glass area	Low Potential Savings
X. Other applicable ECO's Not Applicable	W.	Cargo door strip curtains	Not Applicable
	х.	Other applicable ECO's	Not Applicable

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ARE	A: <u>RK</u> BUILDING NAME: <u>Igniter Assemb</u>	oly	NUMBER: 5010-00
	ECO Description		Project Status
Α.	Production equipment changes N	lot	Applicable
в.	Efficient motors & var. speed drive E	CO	Analysis Performed
C.	Production equipment scheduling N	lot	Applicable
D.	Waste heat recovery L	_OW	Potential Savings
Ε.	Automated production controls	Not	Applicable
F.	Improve facility layout	-0W	Potential Savings
G.	Solar applications L	_OW	Potential Savings
н.	Consolidate processes L	_OW	Potential Savings
ī.	Building ventilation systems L	-0W	Potential Savings
J.	Production equipment maintenance N	Vot	Applicable
к.	Improved methods/controls L	-OW	Potential Savings
L.	Steam/condensate distribution N	Vot	Applicable
М.	Compressed air systems	vot	Applicable
N.	Lighting systems E	ECO	Analysis Performed
0.	Electrical distribution	Not	Applicable
Ρ.	Radiant heating	Not	Applicable
Q.	Loading dock seals	Vot	Applicable
R.	Thermal energy storage	_OW	Potential Savings
s.	Flue gas recirculation	Not	Applicable
Т.	Ventilation instead of A/C L	_OW	Potential Savings
υ.	Insulation	Not	Applicable
v.	Reduction of glass area	_OW	Potential Savings
W.	Cargo door strip curtains	Not	Applicable
х.	Other applicable ECO's	Not	Applicable

Paste

ARE	Paste A: <u>lst R.P.</u> BUILDING NAME: <u>Blending House</u>	NUMBER: 6304
	ECO Description	Project Status
Α.	Production equipment changes	LPS
B.	Efficient motors & var. speed drive	ECO
c.	Production equipment scheduling	LPS
D.	Waste heat recovery	LPS
E.	Automated production controls	LPS
F.	Improve facility layout	LPS
G.	Solar applications	LPS
н.	Consolidate process	LPS
ī.	Building ventilation systems	LPS
J.	Production equipment maintenance	LPS
ĸ.	Improved methods/controls	LPS
L.	Steam/condensate distribution	LPS
M.	Compressed air systems	NA
N.	Lighting systems	ECO
0.	Electrical distribution	LPS
P.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
т.	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
Χ.	Other applicable ECOs	LPS

AREA: 1st R.P. BUILDING NAME: Speed Roll House NUMBER: 7104

	ECO Description	Project Statu
Α.	Production equipment changes	LPS
В.	Efficient motors & var. speed drive	ECO
c.	Production equipment scheduling	LPS
D.	Waste heat recovery	LPS
Ε.	Automated production controls	LPS
F.	Improve facility layout	LPS
G.	Solar applications	LPS
н.	Consolidate process	LPS
ī.	Building ventilation systems	LPS
J.	Production equipment maintenance	LPS
ĸ.	Improved methods/controls	LPS
L.	Steam/condensate distribution	LPS
М.	Compressed air systems	NA
N.	Lighting systems	ECO
0.	Electrical distribution	LPS
Р.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
т.	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
χ.	Other applicable ECOs	LPS

ARE	A: <u>RP</u> BUILDING NAME: <u>Dry House No</u>	0. 6 NUMBER: 7106-06
	ECO Description	Project Status
Α.	Production equipment changes	Not Applicable
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	ECO Analysis Performed
E.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Low Potential Savings
н.	Consolidate process	Not Applicable
I.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
κ.	Improved methods/controls	ECO Analysis Performed
L.	Steam/condensate distribution	Low/No Cost Project
М.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Ρ.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
S. T.	Flue gas recirculation  Ventilation instead of A/C	Not Applicable  Not Applicable
т.	Ventilation instead of A/C	Not Applicable
T. U.	Ventilation instead of A/C Insulation	Not Applicable Low/No Cost Project

B. Efficient motors & var. speed drive	ARE	A: <u>RK</u> BUILDING NAME: <u>Roll House</u>	NUMBER: 7113-RK
B. Efficient motors & var. speed drive   C. Production equipment scheduling   D. Waste heat recovery   E. Automated production controls   E. Automated productions   E. Automated Savings   Not Applicable   E. Applicable   E. Automated Savings   E. Automated Sa		ECO Description	Project Status
C. Production equipment scheduling  D. Waste heat recovery  E. Automated production controls  E. Automated production savings  E. Automated production Savings  E. Automated production Savings  E. Automated Potential Savings  E. Automate	Α.	Production equipment changes	ECO Analysis Performed
D. Waste heat recovery  E. Automated production controls  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate processes  Low Potential Savings  J. Production equipment maintenance  Not Applicable  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performe  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  R. Thermal energy storage  Low Potential Savings  S. Flue gas recirculation  Not Applicable	В.	Efficient motors & var. speed drive	ECO Analysis Performed
E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate processes  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  M. Lighting systems  C. Electrical distribution  R. Radiant heating  R. Thermal energy storage  S. Flue gas recirculation  Low Potential Savings  Low Potential Savings  Not Applicable	c.	Production equipment scheduling	Low Potential Savings
F. Improve facility layout  G. Solar applications  H. Consolidate processes  Low Potential Savings  Not Applicable  Not Applicable  Not Applicable  M. Compressed air systems  Not Applicable  P. Radiant heating  Not Applicable  R. Thermal energy storage  S. Flue gas recirculation  Not Applicable	D.	Waste heat recovery	Low Potential Savings
G. Solar applications  H. Consolidate processes  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  M. Lighting systems  D. Electrical distribution  P. Radiant heating  G. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  Low Potential Savings  Low Potential Savings  Low Potential Savings  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable	E.	Automated production controls	Low Potential Savings
H. Consolidate processes  I. Building ventilation systems  Low Potential Savings  J. Production equipment maintenance  K. Improved methods/controls  Not Applicable  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performe  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  Not Applicable	F.	Improve facility layout	Low Potential Savings
I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  Radiant heating  Not Applicable  Not Applicable  Not Applicable  Loading dock seals  Not Applicable  R. Thermal energy storage  S. Flue gas recirculation  Not Applicable	G.	Solar applications	Low Potential Savings
J. Production equipment maintenance Not Applicable  K. Improved methods/controls Not Applicable  L. Steam/condensate distribution Not Applicable  M. Compressed air systems Not Applicable  N. Lighting systems ECO Analysis Performe  O. Electrical distribution Not Applicable  P. Radiant heating Not Applicable  Q. Loading dock seals Not Applicable  R. Thermal energy storage Low Potential Savings  S. Flue gas recirculation Not Applicable	н.	Consolidate processes	Low Potential Savings
K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performe  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  Not Applicable  Not Applicable	I.	Building ventilation systems	Low Potential Savings
L. Steam/condensate distribution Not Applicable  M. Compressed air systems Not Applicable  N. Lighting systems ECO Analysis Performe  O. Electrical distribution Not Applicable  P. Radiant heating Not Applicable  Q. Loading dock seals Not Applicable  R. Thermal energy storage Low Potential Savings  S. Flue gas recirculation Not Applicable	J.	Production equipment maintenance	Not Applicable
M. Compressed air systems  Not Applicable  ECO Analysis Performe  D. Electrical distribution  P. Radiant heating  Not Applicable  Loading dock seals  Not Applicable  R. Thermal energy storage  Low Potential Savings  S. Flue gas recirculation  Not Applicable	ĸ.	Improved methods/controls	Not Applicable
N. Lighting systems  C. Electrical distribution  P. Radiant heating  Not Applicable  Not Applicable  Not Applicable  Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  Not Applicable	L.	Steam/condensate distribution	Not Applicable
O. Electrical distribution Not Applicable  P. Radiant heating Not Applicable  Q. Loading dock seals Not Applicable  R. Thermal energy storage Low Potential Savings  S. Flue gas recirculation Not Applicable	M.	Compressed air systems	Not Applicable
P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  Low Potential Savings  Not Applicable	N.	Lighting systems	ECO Analysis Performed
Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  Not Applicable  Not Applicable	0.	Electrical distribution	Not Applicable
R. Thermal energy storage Low Potential Savings S. Flue gas recirculation Not Applicable	Ρ.	Radiant heating	Not Applicable
S. Flue gas recirculation Not Applicable	Q.	Loading dock seals	Not Applicable
	R.	Thermal energy storage	Low Potential Savings
	s.	Flue gas recirculation	Not Applicable
T. Ventilation instead of A/C Low Potential Savings	Т.	Ventilation instead of A/C	Low Potential Savings
U. Insulation Not Applicable	U.	Insulation	Not Applicable
V. Reduction of glass area Low Potential Savings	v.	Reduction of glass area	Low Potential Savings
W. Cargo door strip curtains Not Applicable	W.	Cargo door strip curtains	Not Applicable
X. Other applicable ECO's Not Applicable	×.	Other applicable ECO's	Not Applicable

A. Production equipment changes Low Potenti	is Performed
B. Efficient motors & var. speed drive ECO Analysis C. Production equipment scheduling Low Potenti D. Waste heat recovery Low Potenti	is Performed
C. Production equipment scheduling Low Potenti D. Waste heat recovery Low Potenti	ial Savings
D. Waste heat recovery Low Potenti	
	lal Savings
E. Automated production controls Low Potenti	
	ial Savings
F. Improve facility layout Low Potenti	ial Savings
G. Solar applications Low Potenti	ial Savings
H. Consolidate processes Low Potenti	ial Savings
I. Building ventilation systems Low/No Cost	Project
J. Production equipment maintenance Not Applica	able
K. Improved methods/controls Low Potenti	ial Savings
L. Steam/condensate distribution Low/No Cost	: Project
M. Compressed air systems Not Applica	able
N. Lighting systems ECO Analysi	is Performed
O. Electrical distribution Not Applica	able
P. Radiant heating Not Applica	able
Q. Loading dock seals Not Applica	able
R. Thermal energy storage Not Applica	able
S. Flue gas recirculation Not Applica	able
T. Ventilation instead of A/C Not Applica	able
U. Insulation Not Applica	able
V. Reduction of glass area Low Potenti	ial Savings
W. Cargo door strip curtains ECO Analysi	is Performed
X. Other applicable ECO's Not Applica	able

Carpet Roll & Slitter House NUMBER: 7127

	ECO Description	Project Status
A.	Production equipment changes	LPS
В.	Efficient motors & var. speed drive	ECO
c.	Production equipment scheduling	LPS
D.	Waste heat recovery	LPS
E.	Automated production controls	LPS
F.	Improve facility layout	LPS
G.	Solar applications	LPS
Н.	Consolidate process	LPS
<u>I.</u>	Building ventilation systems	LPS
J.	Production equipment maintenance	LPS
Κ.	Improved methods/controls	LPS
L.	Steam/condensate distribution	LPS
M.	Compressed air systems	NA
N.	Lighting systems	ECO
0.	Electrical distribution	LPS
P.	Radiant heating	LPS
Q.	Loading dock seals	NA
R.	Thermal energy storage	NA
s.	Flue gas recirculation	NA
T.	Ventilation instead of A/C	NA
U.	Insulation	LPS
٧.	Reduction of glass area	LPS
W.	Cargo door strip curtains	NA
<u>x.</u>	Other applicable ECOs	LPS

ARE	A: <u>RK</u> BUILDING NAME: <u>Ex. Grain Fi</u>	<u>nish</u> NUMBER: 7801-00
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
C.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Not Applicable
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Low/No Cost Project
G.	Solar applications	Not Applicable
н.	Consolidate processes	Not Applicable
I.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
K.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Review Previous EEAP
М.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
υ.	Insulation	Low Potential Savings
v.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Low/No Cost Project

ARE.	A: NG BUILDING NAME: Slurry Mix	NUMBER: 9304-00
	ECO Description	Project Status
Α.	Production equipment changes	ECO Analysis Performed
В.	Efficient motors & var. speed drive	Not Applicable
c.	Production equipment scheduling	Not Applicable
D.	Waste heat recovery	Not Applicable
Ε.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate processes	Not Applicable
ī.	Building ventilation systems	Not Applicable
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Not Applicable
N.	Lighting systems	Not Applicable
0.	Electrical distribution	Not Applicable
P.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
U.	Insulation	Low Potential Savings
٧.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

ARE	A: RP BUILDING NAME: Rolled Powde	number: 9309-03
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
C.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	ECO Analysis Performed
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Low Potential Savings
G.	Solar applications	Low Potential Savings
н.	Consolidate process	Low Potential Savings
I.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Low/No Cost Project
L.	Steam/condensate distribution	Review Previous EEAP
М.	Compressed air systems	Low Potential Savings
Ν.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Ρ.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
т.	Ventilation instead of A/C	Not Applicable
υ.	Insulation	Low/No Cost Project
٧.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	Low Potential Savings
×.	Other applicable ECO's	Low/No Cost Project

ARE	A: RP BUILDING NAME: Rolled Powde	NUMBER: 9309-04
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
C.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Low Potential Savings
Ε.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Low Potential Savings
G.	Solar applications	Low Potential Savings
н.	Consolidate processes	Not Applicable
ī.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Low/No Cost Project
Μ.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Ρ.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
Т.	Ventilation instead of A/C	Low Potential Savings
U.	Insulation	Not Applicable
v.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

ARE	A: <u>RP</u> BUILDING NAME: <u>Rolled Powde</u>	r NUMBER: 9310-02
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Not Applicable
E.	Automated production controls	Low Potential Savings
F.	Improve facility layout	Low Potential Savings
G.	Solar applications	Low Potential Savings
н.	Consolidate processes	Not Applicable
Ι.	Building ventilation systems	Low/No Cost Project
J.	Production equipment maintenance	Not Applicable
K.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Review Previous EEAP
М.	Compressed air systems	Not Applicable
N.	Lighting systems	ECO Analysis Performed
0.	Electrical distribution	Not Applicable
Ρ.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Low Potential Savings
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Low Potential Savings
U.	Insulation	Not Applicable
٧.	Reduction of glass area	Low Potential Savings
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

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Project Status
Potential Savings
analysis Performed
Potential Savings
applicable
Potential Savings
Potential Savings
Potential Savings
applicable
Potential Savings
Applicable
Applicable
ew Previous EEAP
Applicable
Analysis Performed
Applicable
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Potential Savings
Applicable

A. Production equipment changes B. Efficient motors & var. speed drive C. Production equipment scheduling D. Waste heat recovery E. Automated production controls F. Improve facility layout G. Solar applications H. Consolidate processes I. Building ventilation systems J. Production equipment maintenance K. Improved methods/controls Not Applicable L. Steam/condensate distribution Review Previous EEAP M. Compressed air systems D. Lighting systems ECO Analysis Performed D. Electrical distribution R. Radiant heating D. Loading dock seals R. Thermal energy storage Not Applicable T. Ventilation instead of A/C Not Applicable V. Reduction of glass area Not Applicable Low Potential Savings Not Applicable D. Not Applicable D. Loy Applicable D. Loy Applicable D. Loy Applicable D. Loy Applicable D. Not Applicable D. Loy Applicable D. Not Applicable D. Not Applicable D. Not Applicable D. Not Applicable D. Not Applicable D. Not Applicable D. Not Applicable D. Not Applicable D. Not Applicable D. Not Applicable D. Not Applicable D. Not Applicable D. Not Applicable D. Reduction of glass area D. Not Applicable D. Reduction of glass area D. Not Applicable D. Reduction of glass area D. Not Applicable D. Reduction of glass area D. Not Applicable D. Reduction of glass area D. Not Applicable D. Reduction of glass area D. Not Applicable D. Reduction of glass area D. Not Applicable D. Reduction of glass area D. Not Applicable D. Reduction of glass area D. Not Applicable	ARE	A: RP BUILDING NAME: Rest House	NUMBER: 9334-17
B. Efficient motors & var. speed drive C. Production equipment scheduling D. Waste heat recovery Not Applicable E. Automated production controls Not Applicable F. Improve facility layout G. Solar applications H. Consolidate processes Not Applicable I. Building ventilation systems Low Potential Savings J. Production equipment maintenance Not Applicable K. Improved methods/controls Not Applicable L. Steam/condensate distribution M. Compressed air systems Not Applicable N. Lighting systems O. Electrical distribution P. Radiant heating Q. Loading dock seals Not Applicable R. Thermal energy storage Not Applicable R. Thermal energy storage Not Applicable T. Ventilation instead of A/C Not Applicable U. Insulation Not Applicable V. Reduction of glass area Low Potential Savings Not Applicable V. Reduction of glass area Low Potential Savings Not Applicable Low Potential Savings		ECO Description	Project Status
C. Production equipment scheduling D. Waste heat recovery E. Automated production controls Not Applicable F. Improve facility layout Not Applicable G. Solar applications H. Consolidate processes Not Applicable I. Building ventilation systems J. Production equipment maintenance K. Improved methods/controls Not Applicable L. Steam/condensate distribution Review Previous EEAP M. Compressed air systems Not Applicable N. Lighting systems C. Electrical distribution P. Radiant heating Q. Loading dock seals R. Thermal energy storage Not Applicable S. Flue gas recirculation T. Ventilation instead of A/C Not Applicable V. Reduction of glass area U. Applicable V. Reduction of glass area Low Potential Savings Not Applicable V. Reduction of glass area Low Potential Savings	Α.	Production equipment changes	Not Applicable
D. Waste heat recovery  E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate processes  Not Applicable  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  C. Electrical distribution  P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  T. Ventilation instead of A/C  Not Applicable  V. Reduction of glass area  Not Applicable  Low Potential Savings  Not Applicable  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	В.	Efficient motors & var. speed drive	Low Potential Savings
E. Automated production controls  F. Improve facility layout  G. Solar applications  H. Consolidate processes  Not Applicable  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  Not Applicable  Low Potential Savings  Not Applicable	c.	Production equipment scheduling	Not Applicable
F. Improve facility layout G. Solar applications H. Consolidate processes I. Building ventilation systems J. Production equipment maintenance K. Improved methods/controls L. Steam/condensate distribution M. Compressed air systems Not Applicable N. Lighting systems C. Electrical distribution P. Radiant heating Q. Loading dock seals Not Applicable R. Thermal energy storage S. Flue gas recirculation Not Applicable T. Ventilation instead of A/C Not Applicable V. Reduction of glass area University Not Applicable V. Reduction of glass area Low Potential Savings W. Cargo door strip curtains Not Applicable Low Potential Savings Not Applicable	D.	Waste heat recovery	Not Applicable
G. Solar applications  H. Consolidate processes  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  O. Electrical distribution  P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  V. Reduction of glass area  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Not Applicable  Low Potential Savings  Not Applicable	E.	Automated production controls	Not Applicable
H. Consolidate processes  I. Building ventilation systems  J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  M. Compressed air systems  Not Applicable  N. Lighting systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  D. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	F.	Improve facility layout	Not Applicable
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J. Production equipment maintenance  K. Improved methods/controls  L. Steam/condensate distribution  Review Previous EEAP  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	н.	Consolidate processes	Not Applicable
K. Improved methods/controls  L. Steam/condensate distribution  Review Previous EEAP  M. Compressed air systems  Not Applicable  N. Lighting systems  ECO Analysis Performed  O. Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  Not Applicable  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	ī.	Building ventilation systems	Low Potential Savings
L. Steam/condensate distribution Review Previous EEAP  M. Compressed air systems Not Applicable  N. Lighting systems ECO Analysis Performed  O. Electrical distribution Not Applicable  P. Radiant heating Not Applicable  Q. Loading dock seals Not Applicable  R. Thermal energy storage Not Applicable  S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	J.	Production equipment maintenance	Not Applicable
M. Compressed air systems  Not Applicable  ECO Analysis Performed  D. Electrical distribution  P. Radiant heating  Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  Not Applicable  Not Applicable  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	K.	Improved methods/controls	Not Applicable
N. Lighting systems  C. Electrical distribution  Electrical distribution  Not Applicable  P. Radiant heating  Not Applicable  Q. Loading dock seals  Not Applicable  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	L.	Steam/condensate distribution	Review Previous EEAP
O. Electrical distribution Not Applicable P. Radiant heating Not Applicable Q. Loading dock seals Not Applicable R. Thermal energy storage Not Applicable S. Flue gas recirculation Not Applicable T. Ventilation instead of A/C Not Applicable U. Insulation Not Applicable V. Reduction of glass area Low Potential Savings W. Cargo door strip curtains Not Applicable	M.	Compressed air systems	Not Applicable
P. Radiant heating  Q. Loading dock seals  R. Thermal energy storage  S. Flue gas recirculation  T. Ventilation instead of A/C  U. Insulation  Not Applicable  Not Applicable  Not Applicable  U. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	N.	Lighting systems	ECO Analysis Performed
Q. Loading dock seals  R. Thermal energy storage  Not Applicable  S. Flue gas recirculation  Not Applicable  T. Ventilation instead of A/C  U. Insulation  Not Applicable  V. Reduction of glass area  Low Potential Savings  W. Cargo door strip curtains  Not Applicable	0.	Electrical distribution	Not Applicable
R. Thermal energy storage Not Applicable  S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	Ρ.	Radiant heating	Not Applicable
S. Flue gas recirculation Not Applicable  T. Ventilation instead of A/C Not Applicable  U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	Q.	Loading dock seals	Not Applicable
T. Ventilation instead of A/C Not Applicable U. Insulation Not Applicable V. Reduction of glass area Low Potential Savings W. Cargo door strip curtains Not Applicable	R.	Thermal energy storage	Not Applicable
U. Insulation Not Applicable  V. Reduction of glass area Low Potential Savings  W. Cargo door strip curtains Not Applicable	s.	Flue gas recirculation	Not Applicable
V. Reduction of glass area Low Potential Savings W. Cargo door strip curtains Not Applicable	T.	Ventilation instead of A/C	Not Applicable
W. Cargo door strip curtains Not Applicable	U.	Insulation	Not Applicable
	v.	Reduction of glass area	Low Potential Savings
	W.	Cargo door strip curtains	Not Applicable
X. Other applicable ECO's Not Applicable	х.	Other applicable ECO's	Not Applicable

ARE	A: RP BUILDING NAME: Compressor H	NUMBER: 9354-00
	ECO Description	Project Status
A.	Production equipment changes	Not Applicable
В.	Efficient motors & var. speed drive	ECO Analysis Performed
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Low Potential Savings
Ε.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate processes	Low Potential Savings
ī.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
ĸ.	Improved methods/controls	Low/No Cost Project
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Low Potential Savings
N.	Lighting systems	Low Potential Savings
0.	Electrical distribution	Low Potential Savings
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
υ.	Insulation	Not Applicable
٧.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
		Not Applicable

ARE	A: NG BUILDING NAME: Generator Ho	use NUMBER: 9467-00
	ECO Description	Project Status
Α.	Production equipment changes	Not Applicable
В.	Efficient motors & var. speed drive	Not Applicable
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Low Potential Savings
Ε.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Not Applicable
н.	Consolidate processes	Low Potential Savings
Ι.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
ĸ.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Low Potential Savings
N.	Lighting systems	Low Potential Savings
0.	Electrical distribution	Low Potential Savings
Ρ.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
U.	Insulation	Not Applicable
v.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

ARE	A: NG BUILDING NAME: Compressor F	NUMBER: 9488-00
	ECO Description	Project Status
Α.	Production equipment changes	Low Potential Savings
В.	Efficient motors & var. speed drive	Not Applicable
c.	Production equipment scheduling	Low Potential Savings
D.	Waste heat recovery	Low Potential Savings
E.	Automated production controls	Not Applicable
F.	Improve facility layout	Not Applicable
G.	Solar applications	Low Potential Savings
н.	Consolidate processes	Low Potential Savings
Ι.	Building ventilation systems	Low Potential Savings
J.	Production equipment maintenance	Not Applicable
к.	Improved methods/controls	Not Applicable
L.	Steam/condensate distribution	Not Applicable
М.	Compressed air systems	Low Potential Savings
N.	Lighting systems	Low Potential Savings
0.	Electrical distribution	Low Potential Savings
Р.	Radiant heating	Not Applicable
Q.	Loading dock seals	Not Applicable
R.	Thermal energy storage	Not Applicable
s.	Flue gas recirculation	Not Applicable
T.	Ventilation instead of A/C	Not Applicable
U.	Insulation	Not Applicable
٧.	Reduction of glass area	Not Applicable
W.	Cargo door strip curtains	Not Applicable
х.	Other applicable ECO's	Not Applicable

REYNOLDS, SMITH AND HILLS ARCHITECTS · ENGINEERS · PLANNERS INCORPORATED

SUBJECT RAAP EEAP

COVEY Water Dry Tank Surface SHEET 1 OF

DESIGNER W. T. Todal

CHECKER P. Hutchins DATE 6-4-90

DATE 6/12/96

ECO# FN-4-1

COVER WATER DRY TANK SURFACE WITH SPHERES

## Assumptions:

- 1. Heat losses due to radiation from the tank are neglected due to the low temperature difference and being indoors.
- 2. Heat losses due to convection from the tank are neglected due to the still air conditions in the building.
- 3. The average room conditions are 70 °F db, 60 % RH, 56°F dew point.
- 4. The tank temperature is 1490F. Waterland & Viar, Industrial Steam System Analysis For RAAP.
- 5. The tank diameter is 16 Feet. RAAP building inventory printont.
- 6. The evaporation rate is given by the following equation:  $\dot{M}_{evap}(\frac{16}{hr}) = \frac{A(95 + 0.425 \, V)}{Y} (p_w + p_a)$

ASHRAE HVAC Systems Handbook, 1987, page 20.8.

## Calculations:

Area of surface = Trv2 = Trx(8 ft)2 = 201 ft2

a conduction = UAAT

QEVAPORATION = M (CVAP + CP \* AT)

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ARCHITECTS .	ENGINEE	RS . PL	ANNERS
IN	CORPORAT	ED	

SUBJECT CO	ver Water Dry Tank	AEP NO	
		SHEET 2 OF	
DESIGNER	W.TxTodd	DATE	
CHECKER	04X	DATE	

# Plastic Spheres (Continued):

UTOP = 1/RAIR = 1/0.68 = 1.47 Btu/hr.ft? OF

AT = 149°F - 70°F = 79°F

Y=hfg=heat of vaporization @ 149°F= 1008.3 Btu/b Table 4, p.6.15

Cp = | Btu/16.0F

V = air velocity = 1 ft/min

Pw= Sat. Vapor Press. @149°F ≈ ps = 7.394 in. Hg.

ASHRAE Fund. Table 2, p. 6.8

Pa = Sat. Vapor Press. @ 56°F (d.pt.) = 0.452 in. Hg.

ASHRAE Fund. Table 2, P.6.6

 $\dot{m}_{evap} = \frac{201 \left(95 + 0.425 \times 1\right)}{1008} \left(7.394 - 0.452\right) = \left(16/h_r\right)$ 

Mevap = 132 16/hr

FY 89 WD cycles = 181 FY88 WD cycles x 25 x 106 #NC = 377

377 WD Cycles = 15 Active bldgs = 2 tanks/bldg = 12.6 Cycles tank

FY 88 cycles /tank = 181 wo cycles = 8 bldgs = 2 tanks en = 11.3

Use ~ 12 wo cycles/tank per year

Average cycle time = \frac{65000 hours}{181 cycles} \times \frac{1 day}{24 hrs} = 15 \frac{days}{cycle} = 360 \frac{hrs}{cycle} = 12 \frac{cycle}{24 hrs} \frac{15 days}{cycle} = 360 \frac{hrs}{cycle} = 4320 \text{ hours/yr}

REYNOLDS	,	SMITH	Α	N	D	Н	ILL	s
ARCHITECTS	•	ENGINEE	RS	٠	PL	ΑN	NER	S
	ın	CORPORAT	ΕD					

SUBJECT COVER Water Dry Tank	AEP NO.
DESIGNER W. Ty Todd	DATE

# Plastic Spheres (Continued):

$$Q_{\text{Evap}} = 132 \frac{16}{\text{hr}} \times 4320 \frac{\text{hr}}{\text{yr}} \times \left[1008.3 \frac{\text{Btu}}{16} + 1 \frac{\text{Btu}}{169} \times (149-53)^{2}\right]$$

$$Q_{\text{Evap}} = 570,240 \frac{16}{\text{yr}} \times \left(1008.3 \frac{\text{Btu}}{16} + 96 \frac{\text{Btu}}{16}\right) = 629.7 \frac{\text{MBtu}}{\text{yr}}$$

Exposed Surface Area Reduction By Addition of Plastic Spheres:

minimum:

Maximum = 0.884 (See attached calculations)

Assume 2" plastic spheres with a 1.5" air space

Neglect R-Value of plastic

Minimum RAir space = 0.77 Fr2. hr, of 1981 ASHRAE Fund.
But Page 23.13, Table 2

Usurface = 0.85 x 0.69 Bth + 0.15 x 1.47 Bth hr. ft. of = 0.81 Bth/hr.ft. of

# REYNOLDS, SMITH AND HILLS ARCHITECTS • ENGINEERS • PLANNERS INCORPORATED

SUBJECT CO	ver Water Dry lank	AEP NO
3023201		SHEET 4
		SHEET
DESIGNER	W. T. Todd	DATE
	(XXX	217

$$Q_{\text{cond-new}} = VA\Delta T = 0.51 \frac{\text{Rtn}}{\text{hr.Ft}^{2}\text{of}} \times 201 \text{ft}^{2} \times 79^{\circ} \text{F} \times 4320^{\text{hr}} \text{fr}^{2}$$

$$= 55.6 \text{ MBtu/yr}$$

$$Q_{\text{Evap-new}} = Q_{\text{Evap}} \times (1-0.85) = 629.7 \frac{\text{mBtu}}{\text{hr}} \times 0.15$$

$$= 94.5 \frac{\text{mRtu/yr}}{\text{r}}$$

# Steam Savings:

Savings = 
$$(Q_{01d} - Q_{11ew}) * No. Tanks$$
  
=  $\left[ (100.8 + 629.7) \frac{mBtu}{Yr} - (55.6 + 94.5) \frac{metn}{Yr} \right] * 2 \frac{Tanks}{bldg} * 8 bldg$   
Savings = 9286.4 mBtu/yr

# REYNOLDS, SMITH AND HILLS ARCHITECTS • ENGINEERS • PLANNERS INCORPORATED

SUBJECT COV	er Water Dry T	anks AFP NO		
FN-11-1			5of	
DESIGNER	H			
CHECKED	¥1	DATE		

FN-4-1

# Cost Savings:

Cost Savings = COLL # NEWING - EL PRICE DIFF COSTS = #19,735 - 10,308 = \$9427 yr.

# Construction Cost:

Project Cost = \$49,899 See Construction Cost Estimate Sheet.

2" polypropylene or HDPE hollow spheres

500 balls x 7702 1ft2 = 500 x 77 ft2/case = 10,9 ft2/case

10.9 ft2/case = 0.85 (% cores) = 12.8 ft2 coverage per case

201 ft2 = 12.8 ft2/case = 15.7 = 16 asrs /ta k

# Simple Payback

Poyback = Fost = Savings =  $$^{$49,899 \div $9427}$  = 5.3 years

CONSTRUCTION COST ESTIMATE				June 4, 1990 SHEET 6 OF				6 of		
PROJECT EMERCY ENGINEERING		BASIS FOR ESTIMATE								
ENERGY ENGINEERING ANALYSIS						CODE A (No design completed)				
RADFURD ARMY AMMUN	RADFORD ARMY AMMUNITION PLANT						CODE S (Preliminary design)  CODE C (Final design)			
REYNOLDS, SMITH AN	D HILLS			NC.		THER (Sp				
DRAWING NO.		ESTIM		. Todd		CHECKE	PHW	tchins		
Plastic Balls SUMMARY	QUANT	TY		LABOR		MATERIA	L .	TOTAL		
TIME CIC IDELIS SUMMARY	NO. UNITS	UNIT MEAS.	PER	TOTAL	PER	то	TAL	COST		
2" Plastic balls	16	Case	2.50	40.00	123	1	968.00	2008.00		
Subtotal				40.00		10	168.00	2008.00		
Location Adjustments			0.683	(12.68)	1.002		3.94	(8.74)		
Sales Tax					4.5%		88.74	88.74		
FICA/Insurance		,	20%	5.46				5.46		
Subtotal								2093.46		
Overhead	15 %							314.02		
Profit	10 %							240.75		
Performance Bond	170							26.48		
RAAP Support	60%							160.48		
Contingency	10%							283.52		
. ,										
Construction Cost	per	Ta	nk					3118.71		
	<u> </u>		8 k	mildings x 2	tanks	1610	9	× 16		
·				,			,			
Total Construction	ost							# 49,899.36		
			,							
			·							
			·							
			4.							
Source: Vendor Qu	ote f	rom	Mid	-America	Plas	tics	, Sha	Kopee, MN		
-								•		
<u> </u>										
						1	ł	-		

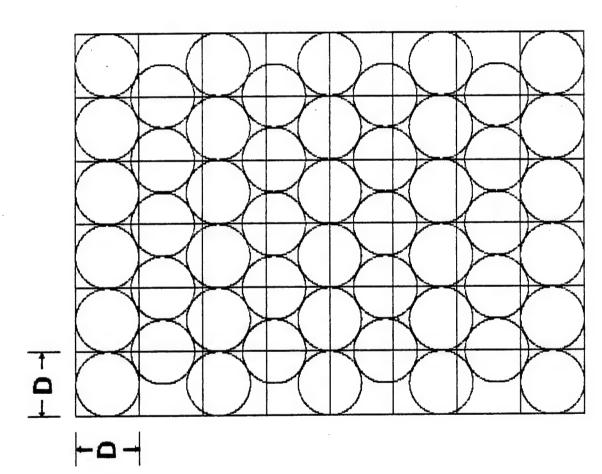
As = Surface Area = 60 x 80

Ac= Circle Areas = 6 × 9 × TrD2

C= % Coverage = Ac x100

9x1 x100 = 9th x100 C= 6×9× TYD2 6D×80 × 100

88.4% ľ



Cover Water Dry Tanks Grains of moisture Pounds of moisture per pound of dry air per pound of dry air \$ \$ S 1 ° 1 <u>8</u> 2 2 7 Based on Statistical Abstract of the United States, 1987 Date PSYCHROMETRIC CHARI 70 of Ab 61 of wb 56 of do pt. Ambiant Londitions: 58°F db 50°F wb Room Conditions: Assume RSH 38 (3-63) Water Dry House Normal Temperatures Dry Bulb

# HunTer

# **Telephone Call Confirmation**

00-11/0-1501	Project No. 2900379-000
800-468-1501 Local (L.D)	
B. Todd	
	Conversed With Coary Lyous
Of Mid-America   lasti	cs Regarding Hollow Plastic Spheres
	4
Dia = 3/4 1000	\$39.40 /case + shipping
11/2" 1000	\$143.50
2" 500	\$123.00
4" 100	#203 <i>.00</i>
PIDAL	~ O.C.
PolyPropylene or Hi	DAE -
	90 Fumes reduction
	33.3 Evap. redution
	69.5 % Fuel savings
· · · · · · · · · · · · · · · · · · ·	
water it all	er (small anomits) and alcohol
with eta.	er (small anomits) and account
2	<del></del>
bary will tax pro	duct info to me today.

MID-AMERICA PLASTICS, N Plastic Specialists / Fabrication & Distribution 700 Industrial Circle So. Shakopaa Minneska (1637) 612/445-7667 / FAX# 612/445-2974 800448-15(H DATE: TO: ATTN: Number of pages (Including this cover page) | O REGARDING: INFO ON DEATE Balls MAP FAX #(612) 445-2974

PLSTCS



CUT HEAT LOSSES ! SAVE FACTORY MAINTENANCE! IMPROVE SAFETY! REMOVE FUNES AND ODORS

#### PROVEN to Reduce Fuel Costs 19.5% Reduces Fumes 50% Reducas Evaporation 88.3% ALL PLASTIC FLOATING SIMERES

Spheres float on surface of liquid in open tank and thereby greatly reduce the exposed liquid surface aren — up to 30%. Drimatically diminishes objectionable jumps and odors. Blanket of appendix also insulates heated liquid reducing evaporation and heat requirements:

Ideal for plating tanks and similar open tank matallations where the liquid surface can be covered with a blanker of spikeres without impeding access to the tank for process purposes.

Sphere: and hollow and will float on any liquid. Fully round. No welt of tim on which chemicals can deposit and being smooth they ensure a rouch tabler surface cover.

Polypropylene, non-texts and able to withstand continuous working temperatures of 110°C (230°F) polypropylene is switched for use in most known chemicals.

High Density Polyethylene generally suitable as above but with a continuous working temperatures limitation of 80°C (176°F) softening point about 110°C (230°F). High density polyethylene has better chemical resistance to certain compounds like oil, and other hydrocarbons. Also less atress cracking at Iciv temperatures their polypropylene: Color white translucent except 100 MM, black for outside use.

HIGH BENSIT POLYPROPYLERS MAEL BIDNS Price I'r

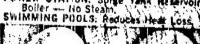
MILL AMERICA PLASTICS, INC. hathe Specialists / Fubrication & Distribution

700 Industrial Circle S. • Brakoree Idingesote 55376

#### APPLICATIONS

METAL WORKING - In Plotting und Chromating PLATING: Manual Chromium Line Reduces Spray
Splashing
PETROLEUM: Air Pollution, Numbus Odors, Waste
Collection Pits.
FOCID: Reduces Vapor, Smelt in Bacon Manufac-

POWER STATION: Surge Tank Reservoir of Hot





#### REYNOLDS, SMITH AND HILLS ARCHITECTS · ENGINEERS · PLANNERS

SUBJECT RA	AAP EEAP	AEP NO
		S OF
	W.T. Todd	6-6-90
CHECKER	PHUTCHINS	DATE 6/12/90

#### ECO# FN-U-2

INSULATE FIBERGLASS WATER DRY TANKS

### Assumptions:

- 1. The heat loss by radiation from the tank is negelected due to the low temperature difference and being indoors.
- 2. The heat loss by convection from the tank is negelected due to the still air conditions in the building.
- 3. The average room temperature is 70°F.
- 4. The tank temperature is 1490F. Waterland and Viar, Industrial Steam System Analysis.
- 5. The tank dimentions are 9 feet high with a 16 foot diameter.
- 6. The Revalue For the Fiberglass tank is approximately equal to that of 1/4" aspestos cement siding.

## Calculations:

REYNOLDS.	SMITH	AND	HILLS
ARCHITECTS .	ENGINEEL	RS . PL	ANNERS
IN	CORPORATE	ED	

SUBJECT	Insi	late	W.D.	Tanks

DESIGNER WITITOdd

# FN-U-Z Water Dry Tank Insulation (Continued):

Add 2" Fiberglass insulation wrap with metal jacketing to the sides of the tank.

From ECO FN-5-1 cales., the water dry tanks operate approximately 4320 hr/yr

### Steam Sarings:

### Coal Savings:

Energy Savings = 2138.0 
$$\frac{m_{Eti}}{\gamma_r} \times 1.32 = 2822 \frac{m_{Eti}}{\gamma_r}$$

Cost Savings =  $\frac{m_{Eti}}{\gamma_r} \times 1.61 \frac{4}{m_{Eti}} = \frac{44543}{4543} / \gamma_r$ 

Elec. Price Diff Cosis = 2138.0  $\frac{m_{Eti}}{\gamma_r} \times 1.11 \frac{4}{m_{Eti}} = \frac{4}{2373} / \gamma_r$  3/91

REYNOLDS.	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS . PL	ANNERS
II	NCORPORATE	ED	

SUBJECT Insulate W.D. Tanks	AEP NO
	SHEET OF
DESIGNER W.T. Todd	DATE
CUECKER	DATE

FN-U-2 Water Dry Tank Insulation (Continued):

### Construction Cost:

Project Cost = #43,512

See Construction Cost Estimate Sheet

### Simple Payback :

$$payback = Cost = Savings$$
  
=  $\frac{4}{43512} \div 2170 = \frac{20.1 \text{ years}}{20.1 \text{ years}}$ 

	CONSTRUCTION COST	FSTIMAT			DATE PREPARED	1000	SHEET	4 OF
	PROJECT	BASIS FO	1990 SHEET 4 OF					
	ENERGY ENGINEERING	×	CODE A (No design	completed)				
	RADFORD ARMY AMMUN		DE 8 (Preliminary d					
	ARCHITECT ENGINEER REYNOLDS, SMITH AND	אוווג (	ΔF	P IN	ıc	or	HER (Specity)	
	DRAWING NO.			ATOR /		1	PHUTC	ſ
	NA	QUANTI		W17				livins
	Ins. W.D. Tanks SUMMARY	NO.	UNIT	PER	TOTAL	PER	TOTAL	TOTAL COST
	2" F.G. Insulation	480	SF	1.14	547.20	0.73	350.40	897.60
	0.010" Aluminum Jacket	480	SF	2.86	1372.80	0.29	139.20	1512.00
	Subtotal				1920.00		489.60	2409.60
	Location Adjustments			0.683	(608.64)	1.002	0.98	(607.62)
	Sales Tax		•			4.5%	22.08	22.08
	FICA/Insurance			20 %	262.27		,	262.27
1								
	Sub total				1573.63		512.66	2086,29
	Overhead	15%					•	312.94
	Profit	10 %						239.92
	Performance Bond	1%						26.39
	RAAP Support	6 %						159.93
	Contingency	10 %						282.55
	7							
	Construction Cost pe	r Tan	K					3,108.02
	'	•		Numb	er of Eibergl	ass ta	nks	×14
					/			
	Total Construction	Cost						\$43,512.28
1								
	Source = Means Mecl	ranica	1	ost	Data			

### **Telephone Call Confirmation**

	•	Project No. $\frac{2}{}$	900379000
Local L.D.	Placed	Rec'd	Date 6-5-90
W. Todd			
Of Jensco S+S Ins			
		0	
Given the c	anditions Si	d suggested	<i>!</i> =
	Nac 101012 21	July 25 C	
1" + 2"	Glasslass	DEA 0 #7:	50 to \$3,00 per 5F
	Jacketing @	1.	
Multiply	y by 2 for	Military 3	oecs.
M			
The above vo	alues are in	istalled cost	<u> </u>
	A		
			· · · · · · · · · · · · · · · · · · ·
	~		
-			

REYNOLDS.	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS · PL	ANNERS
10	CORPORATI	ED	

RA RA	AP EEAP	AFP NO 2900379000
Electric	, Motors T. Took	SHEET OF
DESIGNER	T. Tood	DATE
aureurn		DATE

ECO # GP-B- | REPLACE EXISTING MOTORS : / ENERGY

A computer spread sheet was developed to calculate the costs, heread southers, and pay varies for motors ranging from The to 300 kg. (Page 2 shows the bornulas which are contained in the spread sheet. Pages 6 through 11 are printouts of the spread sheet, for hows of sperations including!

8 hr/day 5 days/wk 8 hr/day 7 days/wk 16 hr/day 5 days/wk 16 hr/day 7 days/wk 24 hr/day 5 days/wk 24 hr/day 7 days/wk

Pages 344 Summarize the costs and savery for all nectors operating J24 hr/day, 5 days/who which we from 10 hp to 150 hp.

REYNOLDS, SMITH AND HILLS ARCHITECTS • ENGINEERS • PLANNERS INCORPORATED

SUBJECT RAP EEAP

ELECTRIC FINANCECC'S

DESIGNER T. TODD

AEP NO Z90 6379 000

SHEET Z OF 11

DATE 5-1-90

ECO# GP-B-1

FEPLACE EXISTING MOTORS W/ ENERGY-EFFICIENT MOTORS CALCULATION

CHECKER

ASSUMPTIONS MOTORS AKE EXPLOSION-PROOF FOR CLASS I, GROUP D & CLASSI, F&G
1800 RPM, 460 V, 3-PHASE

MATERIAL COSTS ARE FROM RELIANCE ELECTRIC COMPANY LIST PRICES, WITH A CONTRACTORS DISCOUNT FACTOR OF 0.75 FOR ENERGY EFFICIENT MOTORS.

LABOR 18STS ARE FROM 1989 HEARS ELECTRICAL CATALOG FOR INSTALLATION OF MOTERS BY HP. THIS VALUE WAS MULTIPLIED BY 2 TO ACCOUNT FOR REMOVAL OF THE CLD METOK. THE LATEOR FACTOR OF 0.683 WAS USED TO ADJUST FOR GEOGRAPHICAL LOCATION.

NET (OST (1940 +) = (1.045 x MAT'L + 1.2 x LAROK) x 1.661

SAVINGS = MOTOR HP & 0.746 KW X 1 1 1 YR X \$0.03026 HP S-D NOM. EFF. EE NOM. EFF. YR KWH

FAYEACK = NET COST (\$) = YRS
SAVINGS (\$/YR)

## 

DATE: 12 JUNE 90

				CONTRACTOR	LABOR		R	REPLACE OPERATING MOTO			'ION
	V0.00	momar.	NO. OF	RELIANCE	REMOVE OR	CONSTR COST		ENERGY SAVINGS		COST SAVINGS	
	MOTOR SIZE (HP)	TOTAL NO. OF MOTORS	MOTORS OPERATING 3 SH,5 D/W	ENERGY-EFF. EXP-PROOF ( (1990\$)	INSTALL MOTOR (1990\$)	(1990\$)	PER MOTOR (KWH/YR)	TOTAL (KWH/YR)	(MMBTU/YR)	PER MOTOR (\$/YR)	TOTAL (\$/YR)
	10	523	105	928	33	164,216	2,837	297,878	1,017	86	9,014
	15	412		1,213	42	167,029	5,522	452,777	1,545	167	13,701
	20	184		1,440	51	89,722	6,873	254,284	868	208	7,695
-	25	288		1,806	53	174,117	7,053	409,079	1,396	213	12,379
	30	166		2,029	55	110,752	7,635	251,968	860	231	7,625
	40	157	31		66	139,564	11,464	355,383	1,213	347	10,754
	50	140		3,223	82	148,684	9,373	262,451	896	284	7,942
	60	100		4,511	96	147,275	14,090	281,796	962	426	8,527
	75	71	14	5,509	109	125,533	19,557	273,794	934	592	8,285
	100	67	13	6,900	147	146,468	28,130	365,692	1,248	851	11,066
	125	44		9,023	188	132,458	37,709	339,384	1,158	1,141	10,270
	150	28	6	10,273	222	100,716	35,619	213,715	729	1,078	6,467
	TOTAL					1,646,533		3,758,200	12,827		113,723

SUMPTION: 20% OF THE MOTORS OPERATE 24 HRS/DAY, 5 DAYS/WEEK

CONSTRUCTION COST	ESTIMA	ΓE		5-17 - 90		SHEET	4 of 11
ENERGY ENGINEERING	ANALYS	IS				OR ESTIMATE	
RADFORD ARMY AMMUN	_	CODE & (No design completed)					
ARCHITECT ENGINEER	_	CODE C (Final deal THER (Specify)	gn)				
REYNOLDS, SMITH AND	HILLS	I = =				CHECKED BY	
E(0#GP-B-1		T	Tod				
Motor Replacementummary	QUANT	UNIT	PER	LABOR	PER	TOTAL	TOTAL
	UNITS	MEAS.	UNIT	TOTAL	UNIT	TOTAL	
Replace Standard duty	436	ca	vanies	26404		1027334	1053738
motors with energy efficient		100.	100102	, 4 10 1			
motors - 10 hathru 150 hp	ł .						
							·
Saks Tax	4.5%		·			46230	46230
FICA/Insurance	20.0%			5281			5281
Subtotal.				31685		1073564	1105249
Overhead	15.0%						165787
Profit	10.0%						127104
Fertomance tout	1.0/	ļ					13981
Hercules Support	6:01,						24727
Continuency JU	10.0%						149685
Construction (cot							1646533
·						· ·	
			<u> </u>				

CONSTRUCTION COST	5-1-90		SHEET E	or 11			
PROJECT ENERGY ENGINEERING	BASIS FOR ESTIMATE  SIZ CODE A (No design completed)						
RADFORD ARBY		CODE C (Final design)					
ARCHITECT ENGINEER REYNOLDS, SMITH AN	ND HILLS	A.E.	P., I	NC.	_	THER (Specify)	
ECO # GP-B-		ESTIM				CHECKED BY	
	QUANT	1	,,,,,	LABOR		MATERIAL	
Moior Fracement SUMMARY	NO.	UNIT MEAS.	PER	TOTAL	PER	TOTAL	COST
5 hp motor	1	la	29	58	636	636	694
inergy- officient,					·		
explosion-proof							
explosion-proof (remove old install ne	w)						
						10	19
Sales tax	4.5%			12		29	29 12
FICA/Insurance	20.0%			†		1/5	
Subtotal	15 00			70		665	735
Overhead	15.0%						110
Profit	10.0%						<b>85</b> 9
Performance Bond	1.0%		<del></del>				56
Hercules Support	6.0%						100
Contingency	10.0%						1095
Construction Cost							1033
				<b>-</b>			
	-			•			
	1						
·	<del> </del>		<u> </u>				
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				1	1		

RAAP ENERGY EFFICIENT NOTOR PROJECTS FILENANE: RHOTEE3

DATE: 8 MAY 98

NEE         RELIANCE         REPPRISE         REPPRISE         REPPRISE         REPPRISE         REPPRISE         REPPRISE         REPPRISE         REPPRISE         REPPRISE         REPRIADIO         GGST         SINPLE           74.01         71.01         42.02         43.02         44.02	LIST PRICE CONTRACTOR LABOR MAT'L & LABOR	LABOR MAT'L	NAT'L	NAT'L				_	EFFICIENCIES		REPLACE	OPERATING	REPLACE OPERATING MOTORS CALCULATION	CULAT ION
NOM. EFF.         NIN EFF.         NOM EFF.         SAVINGS         DEMAND         SAVINGS         PAYER           12         (1)         (1	RELIANCE RELIANCE REMOVE OR 'REMOVE OR PRICE RELIANCE ENERGY-EFF, INSTALL INSTALL W/ MARKUPS STD MOTOR	RELIANCE RENDVE OR "REHOVE OR PRICE ENERGY-EFF. INSTALL INSTALL W/ MARKUPS	REMOVE OR PRICE INSTALL W/ MARKUPS	PRICE W/ MARKUPS	PRICE Markups	STD NOT	변종	RELIANCE STD MOTOR	RELIANCE EXP-PR XE	EXP-PR XE	ENERGY	REDUCED	1803	SIMPLE
(1)         (2)         (3)         (4) <th>EXP-PROOF MOTOR MOTOR</th> <th>EXP-PROOF MOTOR MOTOR</th> <th>MOTOR</th> <th></th> <th></th> <th>MIN. EF</th> <th></th> <th>NOM. EFF.</th> <th>NIN EFF.</th> <th>NOM EFF.</th> <th>SAVINGS</th> <th>DEHAND</th> <th>SAVINGS</th> <th>PAYBACK</th>	EXP-PROOF MOTOR MOTOR	EXP-PROOF MOTOR MOTOR	MOTOR			MIN. EF		NOM. EFF.	NIN EFF.	NOM EFF.	SAVINGS	DEHAND	SAVINGS	PAYBACK
77.67         82.51         84.67         168         6.1         5           78.52         84.87         85.52         243         6.1         7           81.51         85.52         229         6.1         7           81.52         85.52         229         6.1         7           78.52         87.51         88.52         678         6.3         29           82.52         87.52         86.3         19         19           84.62         89.52         96.2         96.5         29           85.51         89.52         96.5         96.5         29           85.52         91.72         92.42         2291         1.1         69           86.53         91.72         92.42         2351         1.1         71           86.53         91.72         92.42         2351         1.1         71           86.54         91.72         92.42         2351         1.1         71           86.55         93.67         93.67         1.2         95         95           96.21         94.52         4697         2.3         142           96.22         95.42         95.42	(19986) (NEANS 19896) (19986) (19986)	(NEANS 19896) (19986) (19986)	(\$8561) (\$8661)	(\$8661)		2		(2)	(2)	(2)	(KWH/ TK)	(KR)	(3/ IK)	(TKS)
78.5x         84.8x         85.5x         243         0.1         7           81.5z         85.5x         86.5x         220         0.1         7           78.5z         87.5z         86.5x         220         0.1         7           78.5z         87.5z         88.5x         678         0.3         19           82.5z         87.5z         88.5x         638         0.3         19           84.6x         87.5z         90.2x         94.5         0.5         29           85.5z         91.0x         91.7x         1841         0.5         29           85.5z         91.0x         92.4x         2291         1.1         71           86.5z         91.7z         92.4x         2291         1.1         71           86.5z         91.7z         92.4x         224z         234         1.2         77           86.5z         91.7z         92.4x         2345         1.2         77           88.5z         93.0x         2345         1.2         77           96.2z         94.5z         95.0z         6519         3.1         197           96.2z         95.0z         11873	518 43 29 921	518 43 29 921	43 29 921	921		7	4.07				168		S	181.3
81.51         85.52         86.52         220         0.1         7           78.52         87.51         88.52         678         0.3         20           82.51         87.52         88.52         638         0.3         19           82.51         87.52         88.52         90.21         946         0.5         29           85.52         89.51         90.21         94.6         0.5         29         85           85.52         91.72         92.42         2291         1.1         69         56           86.52         91.72         92.42         2291         1.1         71           86.53         91.72         92.42         2291         1.1         71           86.54         91.72         92.42         2291         1.1         71           86.55         91.72         93.62         3821         1.1         71           88.54         93.62         3124         1.5         95           96.24         95.02         6519         3.1         197           96.24         95.02         46.57         2.3         142           96.24         95.02         6519	543 43 29 961	543 43 29 961	43 29 961	196		7	5.5%			_	243	-	7	130.9
78.51         87.52         88.52         678         8.3         28           82.51         87.52         88.52         638         8.3         19           84.87         89.51         98.22         952         8.5         29           85.52         89.51         98.21         946         8.5         29           85.52         91.01         91.71         92.42         2291         1.1         69           86.52         91.72         92.42         2291         1.1         69         56           86.53         91.72         92.42         2291         1.1         71           86.54         91.72         92.42         2391         1.1         71           88.55         91.72         92.42         2345         1.2         77           88.55         93.62         3821         1.1         71           96.24         93.64         93.64         1.5         95           96.24         95.97         46.97         2.3         142           96.24         95.87         95.97         4.5         284           96.24         95.87         95.97         4.5         284	43 29 1864	570 43 29 1884	43 29 1864	100		_	8.52			_	228	-	7	150.7
82.51         87.52         88.52         638         0.3         19           84.87         89.51         90.22         952         0.5         29           85.51         89.52         90.22         946         0.5         29           85.52         89.52         90.22         946         0.5         29           85.52         91.01         91.72         92.42         2291         1.1         69           86.52         91.72         92.42         2291         1.1         71           86.53         91.72         92.42         2291         1.1         71           86.54         91.72         92.42         2351         1.1         71           88.54         92.42         2351         1.1         71           88.55         93.02         93.62         3821         1.8         116           90.27         93.02         93.62         36.7         46.97         2.3         147           90.27         95.02         95.02         95.02         95.02         95.02         95.02         95.02           90.27         95.02         95.02         96.22         1180         5.7         336	574 43 29 1018	574 43 29 1018	43 29 1018	1010		7	5.5%				8/9	.3	28	49.8
84.67         89.57         96.28         95.2         0.5         29           85.51         89.57         90.21         946         0.5         29           85.52         91.01         91.71         1841         0.5         29           86.52         91.01         91.71         1841         0.5         29           86.53         91.01         92.42         2291         1.1         69           87.54         92.42         2351         1.1         71           88.55         92.42         2351         1.1         71           88.57         92.42         2351         1.2         77           90.21         93.62         3821         1.8         116           90.22         94.12         94.52         4697         2.3         142           90.22         94.12         95.02         6519         3.1         197           90.22         95.02         95.02         6519         3.1         197           90.23         95.02         95.02         6.0         380           90.24         95.02         1180         5.7         359           91.72         95.02	636 43 29 1108	636 43 29 1108	43 29 1108	8011		88	78.			_	638	.3	61	57.4
85.51         89.52         98.21         946         9.5         29           85.52         91.01         91.71         1841         0.5         29           86.52         91.01         92.41         2291         1.1         69         56           86.52         91.71         92.41         2291         1.1         69         56           87.52         91.71         92.41         22.41         2341         1.1         71           88.51         92.41         93.62         2345         1.2         77           96.21         93.01         93.61         4697         2.3         142           96.22         94.12         94.51         4697         2.3         142           96.22         94.51         95.01         6519         3.1         197           96.22         95.01         95.02         6519         3.1         197           96.22         95.02         65.99         3.1         197           96.23         11873         5.7         359           93.61         95.81         96.21         11100         5.3         336           94.11         96.21         11201	889 46 31 1387	889 46 31 1387	46 31 1387	1387	1387	8	. 57				952	6.5	29	48.1
B5.5x         91.0x         91.7x         1841         0.9         56           86.5x         91.7x         92.4x         2291         1.1         69           86.5x         91.7x         92.4x         2291         1.1         71           88.5x         92.4x         93.6x         2345         1.2         77           88.5x         93.0x         93.6x         3821         1.8         116           90.2x         93.0x         93.6x         3124         1.5         95           90.2x         94.5x         95.0x         6519         3.1         197           90.2x         94.5x         95.0x         6519         3.1         197           90.2x         95.8x         95.4x         93.77         4.5         284           90.2x         95.8x         96.2x         11873         5.7         359           91.7x         95.8x         96.2x         11100         5.3         336           93.6x         95.8x         96.2x         11201         5.4         339           94.1x         96.2x         11201         5.4         339           94.1x         96.2x         11200         5	928 49 33 1582	928 49 33 1582	49 33 1582	1582	1582		.52				946	.5	29	55.3
86.5x         91.7x         92.4x         2291         1.1         69           87.5x         91.7x         92.4x         2351         1.1         71           88.5x         92.4x         93.6x         2545         1.2         77           88.5x         93.6x         3821         1.8         116           90.2x         93.6x         3124         1.5         95           90.2x         94.5x         95.6x         4697         2.3         142           90.2x         94.5x         95.0x         6519         3.1         197           90.2x         95.8x         95.4x         93.77         4.5         284           90.2x         95.8x         95.8x         95.8x         339           90.2x         95.8x         96.2x         1180         5.7         359           91.7x         95.8x         96.2x         11100         5.3         336           93.6x         95.8x         96.2x         11201         5.4         339           94.1x         96.2x         11201         5.4         339           94.1x         96.2x         11200         5.9         372	1213 61 42 2861	1213 61 42 2861	61 42 2861	2061	2061	80	2.52				1841	6.0	26	37.8
87.5x         91.7x         92.4x         2351         1.1         71           88.5x         92.4x         93.6x         2545         1.2         77           88.5x         93.6x         3821         1.8         116           90.2x         93.6x         3124         1.5         95           90.2x         94.5x         95.6x         4697         2.3         142           90.2x         94.5x         95.0x         6519         3.1         197           90.2x         95.8x         95.4x         9377         4.5         284           90.2x         95.8x         96.2x         11873         5.7         359           91.7x         95.8x         96.2x         11873         5.7         359           93.6x         95.8x         96.2x         11100         5.3         336           93.6x         95.8x         96.2x         11201         5.4         339           94.1x         96.2x         12303         5.9         372	1448 75 51 2453	1448 75 51 2453	75 51 2453	2453	2453	æ	1.92				2291	=	<b>6</b> 9	35,4
68.51         92.41         93.62         2545         1.2         77           68.53         93.61         3821         1.8         116           96.21         93.62         3821         1.8         116           96.22         94.51         94.52         4697         2.3         142           96.22         94.51         95.02         6519         3.1         197           96.22         95.02         95.02         4.5         284           96.23         95.03         96.21         11873         5.7         359           91.72         95.03         96.22         11873         5.7         359           91.73         95.04         96.21         11873         5.7         359           93.61         95.81         96.21         11100         5.3         336           93.62         95.81         96.22         11201         5.4         339           94.11         96.21         12303         5.9         372	1886 78 53 3837	1886 78 53 3837	78 53 3037	3837	3837	86	5.52				2351	-	71	42.7
68.5x         93.6x         3821         1.8         116           90.2x         93.6x         3124         1.5         95           90.2x         94.1x         94.5x         4697         2.3         142           90.2x         94.1x         94.5x         95.0x         4697         2.3         142           90.2x         94.1x         95.0x         95.0x         4.5         284           90.2x         95.0x         95.4x         95.8x         12570         6.0         380           91.7x         95.8x         96.2x         11873         5.7         359           93.0x         95.8x         96.2x         11100         5.3         336           93.6x         95.8x         96.2x         11201         5.4         339           94.1x         96.2x         12303         5.9         372	2029 81 55 3395	2029 81 55 3395	81 55 3395	3395	3395	<b>35</b>	5.5%			-	2545	1.2		44.1
90.21 93.01 93.62 3124 1.5 95 90.22 94.12 94.52 4697 2.3 142 90.22 94.52 95.02 6519 3.1 197 90.22 95.02 95.42 95.77 4.5 284 90.22 95.42 95.82 11270 6.0 380 91.72 95.82 96.22 11100 5.7 359 93.61 95.82 96.22 11201 5.4 339 94.12 96.22 12303 5.9 372	2740 97 66 4554	2740 97 66 4554	97 66 4554	4224	4224	<b>3</b>	5.5				3821	1.8	_	39.4
90.21 94.11 94.51 4697 2.3 142 90.21 94.51 95.01 6519 3.1 197 90.22 95.81 95.42 9377 4.5 284 90.21 95.81 12570 6.0 389 91.72 95.81 96.21 11100 5.3 336 93.61 95.81 96.21 11201 5.4 339 94.11 96.21 12303 5.9 372	3223 129 82 5372	3223 129 82 5372	129 82 5372	5372	5372	86	3.52				3124	1.5		26.8
90.2x 94.5x 95.0x 6519 3.1 197 90.2x 95.8x 95.4x 93.77 4.5 284 90.2x 95.4x 95.8x 12570 6.0 380 91.7x 95.8x 96.2x 11873 5.7 359 93.6x 95.8x 96.2x 11100 5.3 336 93.6x 95.8x 96.2x 11201 5.4 339 94.1x 96.2x 12303 5.9 372	4511 140 96 7449	4511 140 96 7449	148 96 7449	7449	7449	86	.51				4697	2.3		52.4
98.2x 95.8t 95.4t 9377 4.5 284 98.2x 95.4t 95.8t 12578 6.0 389 91.7t 95.8t 96.2t 11873 5.7 359 93.8t 95.8t 96.2t 11100 5.3 336 93.6t 95.8t 96.2t 11201 5.4 339 94.1t 96.2t 96.5t 12383 5.9 372	5509 160 189 9071	5509 160 189 9071	168 . 9871	. 9071	. 9071	æ	3.51				6219	3.1	_	<b>#</b> 9.
90.2x 95.4x 95.8x 12570 6.0 380 91.7x 95.8x 96.2x 11873 5.7 359 93.6x 95.8x 96.2x 11100 5.3 336 93.6x 95.8x 96.2x 11201 5.4 339 94.1x 96.2x 96.5x 12303 5.9 372	6980 215 147 11397	6980 215 147 11397	215 147 11397	11397	11397	00	8.52				9377	4.5		48.2
91.72 95.82 96.22 11873 5.7 359 93.62 95.82 96.22 11188 5.3 336 93.62 95.83 96.22 11281 5.4 339 94.12 96.22 96.53 12383 5.9 372	275 188 14888	9623 275 188 14888	275 188 14888	14888	14888	00	8.53				12570	9.9	•	39.1
93.61 95.81 96.21 11100 5.3 336 93.61 95.81 96.21 11201 5.4 339 94.11 96.21 96.51 12303 5.9 372	18273 325 222 16981	18273 325 222 16981	325 222 16981	18691	18691	<i>ਨ</i>	1.23				11873	5.7		47.3
93.61 95.81 96.21 11281 5.4 339 94.11 96.21 96.51 12383 5.9 372	12488 398 266 28638	12488 398 266 28638	396 266 28638	28638	28638	•	1.7				11100	5,3	,	<b>61.4</b>
94.11 96.21 96.51 12383 5.9 372	15257 455 311 25158	15257 455 311 25158	455 311 25158	25158	25158	5.	3.63				11201	5.4		74.2
	16979 528 355 26665	16979 528 355 26665	528 355 26685	26605	26605	•	3.6				12383	5.9		71.5

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT

MOTORS ARE EXPLOSION-PROOF, 1888 RPM, 468 VOLT, 3 PHASE SAVINGS = HP \* 0.746\*[(1/5] EFF)-(1/EN EFF)] \* HRS/YR \* ELECOST

8 HRS/DAY 5 DAYS/MK =

OPERATING TIMES:

ELECTRICITY COST: AVERAGE OF ENERGY & DENAND CHARGES 60.0303 /KWH

P. 7 GP-E-1

RAAP ENERGY EFFICIENT NOTOR PROJECTS FILENAME: RMOTEE3 DATE: 8 MAY 98

	LIST PRICE	LIST PRICE CONTRACTOR	LABOR	<b>8</b>	NAT'L & LABOR			EFFICIENCIES	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	REPLACE	REPLACE OPERATING NOTORS CALCULATION	10TORS CAL	ULATION
M010R	RELIANCE MOTOR ENERGY-EFF.	RELIANCE ENERGY-EFF.	RENOVE OR INSTALL	REMOVE OR INSTALL	PRICE W/ MARKUPS	RELIANCE STD NOTOR	RELIANCE STD NOTOR	RELIANCE EXP-PR XE	RELIANCE EXP-PR XE	ENERGY	REDUCED	1500	SIMPLE
S17E (HP)	EXP-PROOF (1990\$)	EXP-PROOF (1990\$)	NOTOR (MEANS 1989\$)	MDTOR (1990\$)	(\$8661)	NIN. EFF. (2)	NOM. EFF. (2)	NIN EFF. (X)	NOM EFF. (%)	SAVINGS (KWH/YR)	DEMAND (KW)	SAVINGS (\$/YR)	PAYBACK (YRS)
	869		43	29	921	74.0%				236		7	129.1
5.5	724	543	43	28	. 196	75.51	78.57	84.87	85.51	341		=	93.2
2			43	28		78.5%	_			389		5	187.4
m	765		43	29		75.5%				941	<b>8</b>	28	35.5
, sc	848		+3	æ		80.6%				895	6.3	27	48.9
7.5	1078		46	3	1387	81.51				1337	6.2	7	34.3
=	1237		64	88	1582	82.51				1328	. S.	7	39.4
15	1617		19	42	2061	82.53				2584	6.9	78	26.4
28	1926		. 75	5	2453	84.87	-			3216	-:	47	25.2
75	2408		78	Š	3 3837	85.53				3366	=	100	39.4
38	2705		18	55		86.51				3573	1.2	881	31.4
4	3653		97	99		86.53				2365	1.8	162	28.1
35	1 4297		120	83		88.51				4386	1.5	133	40.5
99	1 6914		140	6	7449	88.51				6593	2.3	200	37.3
75		5 5509	160	169		88.53				9152	3.1	111	32.8
			215	147		88.51				13163	4.5	398	28.6
125			275	. 881		88.51				17646	9.9	234	27.9
158			325	222		98.23				16668	5.7	284	33.7
288	_		398	266		91.73				15583	5,3	412	43.8
250	_	2 15257	455	31		93.6				15725	5.4	476	52.9
30	21438		520	355		93.6				17272	5.9	523	58.9
5			!										

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT

NOTORS ARE EXPLOSION-PROOF, 1888 RPM, 468 VOLT, 3 PHASE SAVINGS = HP \* 0.746\*[(1/ST EFF)-(1/EN EFF)] + HRS/YR \* ELECOST OPERATING TIMES: 8 HRS/DAY

7 DAYS/WK =

2928 HRS/YR

\$8.8383 /KWN ELECTRICITY COST: AVERAGE OF ENERGY & DEMAND CHARGES

RAAP ENERGY EFFICIENT MOTOR PROJECTS FILENANE: RMOTEE3

DATE: 8 NAY 98

RELIANCE   RELIANCE		LIST PRICE	LIST PRICE CONTRACTOR	LABOR		NAT'L & LABOR		•	EFFICIENCIES		REPLACE	OPERATING	REPLACE OPERATING MOTORS CALCULATION	CULATION
CARRENT-EFF.         INISTALL         ININARILY         STIP MOTOR         ETP-PRIOR         ETP-PRI		REL I ANCE	REL IANCE	REMOVE OR	KENOVE OR	PRICE	RELIANCE	RELIANCE	REL JANCE	RELIANCE				
CLITAGE         CLITAGE <t< th=""><th>MOTOR</th><th>₩,</th><th>ENERGY-EFF.</th><th>INSTALL</th><th>INSTALL</th><th>=</th><th>STD NOTOR</th><th>STD MOTOR</th><th>EXP-PR XE</th><th>EXP-PR XE NOW FEF</th><th>SAVINGS</th><th>REDUCED</th><th>COST</th><th>SIMPLE</th></t<>	MOTOR	₩,	ENERGY-EFF.	INSTALL	INSTALL	=	STD NOTOR	STD MOTOR	EXP-PR XE	EXP-PR XE NOW FEF	SAVINGS	REDUCED	COST	SIMPLE
699         518         413         29         921         74,82         77,82         82,52         84,82         85,52         448         85,52         449         81,52         84,82         85,52         449         81,1         19         81,52         84,82         85,52         449         81,1         13         44         81,1         13         44         81,1         13         84,82         85,52         84,82         85,52         86,52         449         81,1         81,52         85,52         86,52         449         81,1         81,52         86,52         86,52         449         81,1         81,52         86,52         86,52         449         81,1         81,52         81,52         86,52         81,72         81,52         81,52         81,52         81,72         81,72         81,72         81,72         81,72         81,72         81,72         81,72<	# (#B)		(1998s)	(NEANS 1989\$)	(199 <b>8</b> \$)	(18661)	(1)	(1)	(2)	(1)	(KWH/YR)	(KH)	(\$/YR)	(YRS)
724         553         43         29         961         75.57         78.57         84.87         85.57         485         61         15           768         578         43         29         1884         75.57         78.57         85.57         448         8-1         13           765         574         43         29         1886         75.57         78.57         87.57         86.57         448         8-1         13           848         636         45         31         1387         81.57         87.57         86.57         96.27         1985         8-5         57           1878         88         49         31         1387         81.57         89.57         96.27         1985         8-5         57           1878         188         31         1387         81.57         89.57         96.27         1891         8-5         57           1878         1867         144         75         2453         86.57         89.57         96.27         1891         8-5         57           1878         1867         187         95.57         89.57         97.47         4782         111         139	-	169	1	£\$	29	921	74.0%				336		9.	9.86
768         570         43         29         1004         78.57         86.57         86.57         440         0.1         13           765         574         43         29         1000         75.57         78.57         86.57         86.57         440         0.1         13           848         658         43         29         1100         75.57         78.57         87.57         88.57         1275         0.2         58           1978         889         46         31         1387         81.57         87.57         188.57         187.5         88.57         188.57 <td>1.5</td> <td>72/</td> <td></td> <td>43</td> <td>29</td> <td>196</td> <td>75.5%</td> <td></td> <td>_</td> <td></td> <td>485</td> <td></td> <td>15</td> <td>65.4</td>	1.5	72/		43	29	196	75.5%		_		485		15	65.4
765         574         43         29         1886         75.57         78.57         86.57         86.57         1348         86.34         41           846         636         43         29         1188         88.87         1275         88.57         1275         89.37         1275         89.37         98.77         196.5         89.57         196.5         89.57         98.77         98.57         98.77 <td>7</td> <td>76</td> <td></td> <td>43</td> <td>29</td> <td>7001</td> <td>78.5%</td> <td></td> <td>_</td> <td></td> <td>7</td> <td></td> <td>13</td> <td>75.4</td>	7	76		43	29	7001	78.5%		_		7		13	75.4
848         636         43         29         1108         88.85         8.55         88.57         1275         0.3         39           1g78         889         46         31         1387         81.57         84.67         99.27         1985         8.5         59           1g78         98         49         33         1582         87.57         85.57         99.27         1891         8.5         57           1g17         1213         61         42         2861         87.57         87.57         91.77         3681         8.5         57           2488         1866         78         53         3837         86.57         87.57         91.77         92.47         4782         1.1         139           2785         286         81         53         3395         86.57         88.57         91.77         92.47         4782         1.1         139           2785         2786         91         55         3375         88.57         99.27         92.47         4782         1.1         149           4297         3223         126         4554         86.57         88.57         99.27         93.67         1.8		3 76		43	29	1010	75.51				1340	•	7	24.9
1978         889         46         31         1387         81.52         84.00         99.51         98.20         1985         8.5         58           1237         928         49         33         1582         82.51         85.50         98.20         1891         0.5         57           1517         1213         61         42         2861         82.51         85.50         91.72         92.47         1891         0.5         57           1928         1440         75         51         2453         84.00         86.52         91.71         92.47         4582         1.1         139           2488         186         78         53         3837         86.51         86.52         91.71         92.41         4582         1.1         142           2785         2829         81         55         3335         86.51         88.51         92.41         93.01         162         16         16         16         165         165         16.51         88.52         94.12         93.01         16         16         143         86.52         94.12         93.02         1.1         142         143         142         142 <td< td=""><td>د به</td><td>348</td><td></td><td>43</td><td>29</td><td>1108</td><td>80.0%</td><td></td><td>_</td><td></td><td>1275</td><td><b>.</b>.3</td><td>33</td><td>28.7</td></td<>	د به	348		43	29	1108	80.0%		_		1275	<b>.</b> .3	33	28.7
1237         928         49         33         1582         82.57         85.51         89.51         189.1         0.5         57           1617         1213         61         42         2861         82.51         85.51         91.71         3681         0.5         111           1928         1440         75         51         2453         84.81         86.51         91.71         92.41         4582         1.1         139           2488         186         78         53         3837         86.51         87.52         91.71         92.41         4782         1.1         139           2785         286         78         53         3335         86.51         88.52         93.61         4782         1.1         142         148         148.51         92.41         93.61         1.2         154         148         148         148         148         1.2         148	7.5			46	31	1387	81.5%				1985		28	24.1
167         1213         61         42         2861         82.57         85.51         91.07         3681         6.9         111           1928         1446         75         51         2453         84.02         86.57         91.72         92.47         4582         1.1         139           2488         1866         78         53         3837         86.57         87.51         92.47         4702         1.1         142           2785         2029         81         55         3395         86.57         88.57         92.47         92.47         4702         1.1         142           2785         2029         81         55         3395         86.57         92.47         93.07         509         1.2         154           4297         3223         120         82         5372         88.57         90.27         93.07         189         1.5         189           6814         4511         148         96         7449         88.57         90.27         93.67         6249         1.5         189           7345         5589         168         149         11397         88.57         96.27         95.07	-			64	33	1582	82.51		-		1881		27	27.6
1926         1448         75         51         2453         84.82         86.52         91.72         92.42         4582         1.1         139           2488         1886         78         53         3837         85.51         87.52         91.72         92.42         4782         1.1         142           2785         2829         81         55         3395         86.52         88.52         92.42         4782         1.1         142           3553         284         86.52         88.52         92.42         93.62         1.2         154           4297         3223         128         82         5372         88.52         93.62         93.62         1.6         154           6814         4511         148         96         7449         88.52         96.21         93.61         94.51         94.51         94.51         189         189         17         96.21         95.61         189         189         18.52         96.21         95.61         189         1.5         189         18.52         96.21         95.62         188         1.488         98.52         96.21         95.62         189         1.3         189 <t< td=""><td>-</td><td>191</td><td></td><td>19</td><td>45</td><td>2051</td><td>82.51</td><td></td><td>•</td><td></td><td>3681</td><td></td><td></td><td>18.5</td></t<>	-	191		19	45	2051	82.51		•		3681			18.5
2488         1886         78         53         3837         85.51         87.52         91.71         92.42         4782         1.1         142           2785         2029         81         55         3395         86.51         88.52         92.42         93.02         58.99         1.2         154           3653         2746         97         66         4554         86.52         88.52         93.02         93.02         7643         1.9         139           4297         3223         120         82         5372         88.52         90.22         93.02         93.62         1.6         1.9         18         18.52         90.22         93.02         94.52         93.02         1.8         1.8         18         18         18         18.52         90.22         94.12         94.52         95.02         1.8         1.8         18         18.52         90.22         94.12         94.52         95.02         1.8         1.8         18         18.52         90.22         95.02         95.02         18         1.8         18         18.8         18.8         18         18         18         18         18         18         18         18	26	192		75	51	2453	84.0%				4582			17.7
2785         2829         81         55         3395         86.57         88.57         92.47         93.67         5896         1.2         154           3653         2746         97         66         4554         86.57         88.57         98.27         93.67         7643         1.9         231           4297         3223         120         82         5372         88.57         90.27         93.67         6249         1.5         189           6014         4511         140         96         7449         88.57         90.27         94.17         94.57         93.93         2.3         284           6014         4511         140         96         7449         88.57         90.27         94.57         94.57         95.67         189         3.1         39.27         95.47         95.67         189         3.1         38.57         90.27         95.47         95.47         95.47         95.47         95.47         95.47         95.47         95.47         95.47         95.47         95.47         95.47         95.47         95.47         95.47         95.47         95.47         96.27         22149         5.7         719	25	248		78	53	3037	85.5%				4782			21.3
3653         2746         97         66         4554         86.5%         88.5%         93.6%         93.6%         7643         1.8         231           4297         3223         120         82         5372         88.5%         96.2%         93.0%         93.6%         7649         1.5         189           4297         3223         120         82         5372         88.5%         96.2%         93.0%         93.5%         1.5         189           6014         4511         140         96         7449         88.5%         96.2%         94.5%         93.93         2.3         284           7345         5569         160         109         90.1         88.5%         96.2%         95.6%         18753         4.5         567           9200         690         96.2%         95.0%         95.4%         95.8%         25140         6.0         761           1203         9823         222         16981         98.2%         95.4%         95.8%         25140         6.0         719           16651         1248         168         96.2%         95.8%         96.2%         22200         57.3         57.5         57.0	: e	278		8	55	3395	86.51				2898			22.0
4297         3223         120         82         5372         88.5%         96.2%         93.6%         6249         1.5         189           4297         3223         120         82         5372         88.5%         96.2%         94.1%         94.5%         93.93         2.3         284           6014         4511         148         96         7449         88.5%         96.2%         94.1%         94.5%         93.93         2.3         284           7345         5589         168         169         9671         88.5%         98.2%         95.6%         18753         4.5         567           9288         6983         275         188         14488         88.5%         96.2%         95.4%         95.8%         25149         6.0         761           12030         9823         222         16981         98.2%         91.7%         95.8%         96.2%         22208         5.7         719           16651         12488         39         26         28639         91.7%         93.0%         96.2%         22402         5.3         672           20342         15257         455         311         25168         95.8%	3	355		16	99	4554	86.5%				7643			19.7
6814         4511         148         96         7449         88.5x         98.2x         94.1x         94.5x         9393         2.3         284           7345         5589         168         189         9671         88.5x         98.2x         94.5x         95.6x         13638         3.1         395           9288         6980         215         147         11397         88.5x         98.2x         95.6x         18753         4.5         567           12839         9823         275         188         1488         88.5x         90.2x         95.8x         25149         6.8         761           13697         18273         325         222         16981         98.2x         91.7x         95.8x         96.2x         23746         5.7         719           16651         12488         39         266         28638         91.7x         93.8x         96.2x         22288         5.3         672           28342         1557         455         311         25158         93.6x         95.8x         96.2x         22482         5.4         678           28342         1557         458         95.8x         95.8x         96.2x <td>· 5</td> <td>429</td> <td></td> <td>120</td> <td>87</td> <td>5372</td> <td>88.5%</td> <td></td> <td>-</td> <td></td> <td>6249</td> <td></td> <td></td> <td>28.4</td>	· 5	429		120	87	5372	88.5%		-		6249			28.4
7345         5589         160         189         9871         88.5%         98.2%         94.5%         95.8%         13838         3.1         395           9288         6980         215         147         11397         88.5%         98.2%         95.8%         95.4%         18753         4.5         567           12830         98.2         275         188         1488         88.5%         98.2%         95.8%         25149         6.0         761           13697         18273         325         222         16981         98.2%         91.7%         95.8%         96.2%         23746         5.7         719           16651         12488         39         266         28630         91.7%         93.0%         95.8%         96.2%         22206         5.7         719           28342         1557         455         311         25150         93.6%         95.8%         96.2%         22402         5.4         678           28342         1557         455         311         25150         93.6%         95.8%         96.2%         22402         5.4         678           21438         16879         520         355         26685	3	1999		148	96	7449	88.5%				9393			26.2
928B         698B         215         147         11397         68.5%         98.2%         95.4%         18753         4.5         567           1283B         9823         275         188         1488B         88.5%         98.2%         95.4%         95.8%         2514B         6.8         761           13697         18273         325         222         16981         98.2%         91.7%         95.8%         96.2%         23746         5.7         719           16651         1248B         33B         266         2863B         91.7%         93.8%         96.2%         2220B         5.3         672           28342         15257         455         311         2515B         93.8%         95.8%         96.2%         224B2         5.4         678           2143B         16879         52B         26685         93.8%         94.1%         96.2%         24686         5.9         745	75	734		160	189	9071	88.5%				13038			23.
12830         9823         275         188         14888         88.5x         98.2x         95.4x         95.4x         95.8x         25140         6.0         761           13697         10273         325         222         16981         98.2x         91.7x         95.8x         96.2x         23746         5.7         719           16651         12488         336         266         20630         91.7x         93.0x         95.8x         96.2x         22200         5.3         672           20342         15257         455         311         25150         93.0x         93.6x         95.8x         96.2x         22402         5.4         678           21438         16079         520         355         26605         93.0x         94.1x         96.2x         24606         5.9         745	-			215	147	11397	88.5%				18753			28.1
13697         18273         325         222         16981         98.2x         91.7x         95.8x         96.2x         23746         5.7         719           16651         12488         398         266         28638         91.7x         93.8x         95.8x         96.2x         22288         5.3         672           28342         1557         455         311         25158         93.8x         93.6x         95.8x         96.2x         22482         5.4         678           21438         16879         528         355         26685         93.0x         94.1x         96.2x         24686         5.9         745	125			275	188	14888	88.5%				25140			19.6
16651         12488         398         266         28638         91.7%         93.8%         95.8%         96.2%         22288         5.3         672           28342         15257         455         311         25158         93.8%         93.6%         95.8%         96.2%         22482         5.4         678           21438         16879         528         355         26685         93.0%         94.1%         96.2%         24686         5.9         745	12			325	222	18691	98.2%				23746			23.6
20342 15257 455 311 25159 93.0X 93.6X 95.8X 96.2X 22402 5.4 678 21438 16079 520 355 26605 93.0X 94.1X 96.2X 96.5X 24606 5.9 745	200			398	566	28638	17.16				22200			30.7
21438 16079 520 355 26605 93.01 94.11 96.21 96.51 24606 5.9 745	25			455	311	25158	93.83				22482			37.1
	300		_	520	355	26605	93.61				24686			35.7

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT

MOTORS ARE EXPLOSION-PROOF, 1880 RPM, 460 VOLI, 3 PHASE SAVINGS = HP \* 0.746\*[(1/S] EFF)-(1/EN EFF)] \* HRS/YR \* ELECOSI

16 HRS/DAY 5 DAYS/WK = 4168

OPERATING TIMES:

5 DAYS/WK = 4168 HRS/YR ELECTRICITY COST: AVERAGE OF ENERGY & DENAND CHARGES \$8.8383 /KWH

RAAP ENERGY EFFICIENT HOTOR PROJECTS

FILENANE: RNOTEE3 BATE: 8 MAY 98

;	RELIANCE ENERGY-EFF. EXP-PROOF (1990s)											
(1998\$) 698 724 768 768 848	- 1	INSTALL MOTOR	REMOVE OR INSTALL MOTOR	PRICE W/ MARKUPS	RELIANCE STD MOTOR MIN. EFF.	RELIANCE STD NOTOR NOM. EFF.	RELIANCE EXP-PR XE MIN EFF.	RELIANCE EXP-PR XE NOM EFF.	ENERGY	REDUCED	COST	SIMPLE
		(NEANS 19898)	(\$8661)	(18861)	(3)	(1)	(7)	(1)	(KMH/YR)	(KH)	(\$/YR)	(YRS)
	855	43	29	921	74.6%		_		471		41	64.6
	543	£	23	196	75.5%		~		682	_	71	46.6
	578	#3	29	1881	78.51	81.51	85.51	86.51	618	-	61	53.7
	574	43	23	1818	75.5%		_		1881	•	27	17.7
	953	· •	29	1188	80.6%		_		1798	. 3	Š	28.5
	6	9	3 8	1387	81.51				2674	_	8	17.1
	928	\$	33	1582	82.51				2655	_		19.7
15 1617	1213	9	42	2861	82.51				5168			13.7
28 1928	1448	75	i.	2453	84.63				6432			12.6
25 2488	1886	78	23	3837	85.53				6681			15.7
30 2705	2029	6	55	3395	86.53				7146			12.1
46 3653	274	76	99	4554	86.53				18729			14.6
2607	3223	128	82	5372	88.53				8772			<b>78</b> .
68 6814	4511	148	96	7449	88.5				13187			
75 7345	5509	160	189	1/06	88.5				18383			16.
	6988	215	147	11397	88.5				26327			=
125 12838	9823	275	881	14888	88.5				35292		_	13.
	18273	325	222	16981	98.2				33336		_	16.
	12488	398	266	28638	91.7				31165			21.
258 28342	15257	455	311	25150	93.6				31458	5.4	1 952	26.
	16.079	528	355	266#5	93.6				34544		_	25.

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT

NOTORS ARE EXPLOSION-PROOF, 1888 RPM, 468 VOLT, 3 PHASE . SAVINGS = HP \* 8.746\*[(1/ST EFF)-(1/EN EFF)] \* HRS/YR \* ELECOST

16 HRS/DAY

OPERATING TIMES:

HMX/ 6868.0\$ 7 DAYS/NK = 5848 HRS/YR ELECTRICITY COST: AVERAGE OF ENERGY & DEMAND CHARGES \$0

NOTOR PROJECT!		
RAAP ENERGY EFFICIENT MOTOR PROJECTS	FILENANE: RNOTEE3	DATE: 8 MAY 98

•												1	
MOTOR E	RELIANCE ENERGY-EFF.	RELIANCE ENERGY-EFF.	RENOVE OR INSTALL	RENOVE OR INSTALL	PRICE W/ MARKUPS	RELIANCE STD NOTOR	RELIANCE STD NOTOR	RELIANCE EXP-PR XE	RELIANCE EXP-PR XE	ENERGY	REDUCED	1500	SIMPLE
SIZE (HP)	EXP-PROOF (1990\$)	EXP-PROOF (1998s)	NOTOR (NEANS 1989\$)	NDTOR (1990\$)	(\$8661)	NIN. EFF. (2)	NOM. EFF. (1)	HIN EFF. (X)	NOM EFF. (X)	SAVINGS (KWH/YR)	DEMAND (KN)	SAVINGS (\$/YR)	PAYBACK (YRS)
-	969	518	43	29	921	74.01				196		15	68.4
'n	724	543	43	29	961	75.5%	78.5%	84.61	85.51	728	<b>.</b> 1.	22	43.6
7	760	570	43	82	1884	78.5%				999	<b>6</b> .1	20	50.2
m	765	574	43	29	1919	75.57				2010	.3	19	16.6
S	848	929	43	29	1108	80.02		-		1913	6.3	88	1.61
s.	1078	688	46	31	1387	81.52				2857	6.5	98	16.0
	1237	928	64	33	1582	82.51				2837	6.5	98	18.4
S	1617	1213	61	42	2861	82.51				5522	6.9		12.3
<b>G</b>	1928	1410	75	51	2453	84.62				6873	=		1.8
2	2408	1886		53	3037	85.53				7053	-:		14.2
30	2785	2829		55	3395	86.53				7635	1.2		14.7
6	3653	2748	76	99	4554	86.53				11464	1.8		13.1
5	4297	3223	120	82	5372	88.53				9373	1.5		18.9
	6814	4511		96	7449	88.51				14898	2.3	456	17.5
,	7345	5589		189	1786	88.53				19557	3.1		15.3
=	9200	8869		147	11397	88.53				28130	4.5		13.4
125	12838	9823		188	14888	88.53				37709	6.0	_	13.6
	13697	18273	325	222	18691	98.23				32619	5.7	1878	15.8
288	16991	12488	396	266	28638	91.73				33388	5.3	_	28.5
258	20342	15257	455	311	25150	93.60				33684	5.4	_	24.7
9	*****	4500	600	220	30770	00 00				25010	u	•	23 0

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT

NOTORS ARE EXPLOSION-PROOF, 1880 RPN, 460 VOLT, 3 PHASE SAVINGS = HP \* 8.746\*[(1/ST EFF)-(1/EN EFF)] \* HRS/YR \* ELECOST 24 HRS/DAY OPERATING TIMES:

6248 HRS/YR 5 DAYS/WK =

\$9.0383 /KWH ELECTRICITY COST: AVERAGE OF ENERGY & DEMAND CHARGES

MOTOR PROJECTS		
MOTOR		
IAAP ENERGY EFFICIENT	RMOTEE3	98
ENERGY	ILENAMES RY	ATE: 8 MAY 98
AAP	I E	ATE

ENERGY-EFF, ENERGY-ERP-PR (1990) (199		¥	HAI'L & LABUK				1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				* * * * * * * * * * * * * * * * * * * *
(1998) (1998) (1998) (1998) (1998) (1998) (1998) (1998) (1978) (1	E REMOVE OR	REMOVE OR INSTALL	PRICE W/ MARKUPS	RELIANCE STD MOTOR	RELIANCE STD MOTOR	RELIANCE EXP-PR XE	RELIANCE EXP-PR XE	ENERGY	REDUCED	1803	SINPLE
698 724 768 765 848 1878 1617 1617 1617 1617 1617 1617 161	5	H010R (1998\$)	(\$8661)	MIN. EFF.		MIN EFF.	NON EFF.	SAVINGS (KWH/YR)	DEMAND (KW)	SAVINGS (\$/YR)	PAYBACK (YRS)
724 724 765 848 1878 1617 1617 1617 1920 2785 2785 3653 4297 6814 7345 13697		96	100	70 11	¥0 FF			TAT	d	16	4.5 0
724 765 848 1878 1617 1617 1617 1920 2765 2765 3653 4297 6814 7345 13697	2	<b>2</b>	176	74.84	70.//	_				17	
768 765 848 1878 1617 1617 1920 2785 2785 3653 4297 6814 7345 12838 13697	43	29	196	75.51	78.5%			1622	=	31	31.1
765 848 1878 1237 1617 1920 2785 2785 3653 4297 6814 7345 12838 12838	78 43	29	1881	78.51	81.51		_	927		<b>58</b>	35.8
848 1878 1237 1617 1928 2785 2785 3653 4297 6814 7345 12838 12838	74 43	29	1818	75.51	78.5%			2822	6.3	82	11.8
1878 1617 1617 1920 2468 2705 3653 4297 6814 7345 9200 12838	36 43	23	1108	80.01	82.51			2685	8.3	8	13.6
1237 1617 1928 2488 2785 3653 4297 6814 7345 9208 12838	94 68	31	1387	81.5%	84.0%			4011	0.5	121	11.4
1617 1920 2468 2765 3653 4297 6814 7345 9260 12638	28 49	8	1582	82.51			•	3983	6.5	121	13.1
1928 2468 2765 3653 4297 6814 7345 9268 12838	13 . 61	42	2861	82.51				7752	6.6	235	8.8
2488 2705 3653 4297 6814 7345 9288 12038	15	25	2453	84.81				9648	-:	292	4.8
2785 3653 4297 6814 7345 9288 12838	96 78	53	3837	85.5%				1866		388	18.1
3653 4297 6814 7345 9288 12838 13697	29 81	55	3395	86.5%				10719	1.2	324	10.5
4297 6814 7345 9268 12838 13697	76 97	99	4554	86.5%				16894	1.8	487	9.4
6814 7345 9268 12838 13697	23 120	82	5372	88.5%				13159	1.5	398	13.5
7345 9200 12038 13697		96	7449	88.57				19786	2.3	599	12.4
9200 12030 13697		189	9471	88.5%				27455	3.1	831	19.9
12038		147	11397	88.57				39498	4.5	1195	9.5
13697		188	14888	88.5%				52938	9.9	1602	9.3
	73 325	222	16981	98.2%				28884	5.7	1513	11.2
16651		566	28638	91.72				46748	5.3	1415	14.6
258 28342 15257	57 455	311	25159	93.6%	93.61	95.81	96.21	47174	5.4	1427	17.6
	79 528	355	26605	93.0%				51815	5.9	1268	17.0

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT

MOTORS ARE EXPLOSION-PROOF, 1888 RPN, 469 VOLT, 3 PHASE SAVINGS = HP \* 0.746\*[(1/ST EFF)-(1/EN EFF)] \* HRG/YR \* ELECOST 24 HRS/DAY OPERATING TINES:

8768 HRS/YR 7 DAYS/WK

40.0303 /KWH ELECTRICITY COST: AVERAGE OF ENERGY & DENAND CHARGES

REYNOLDS.	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS · PL	ANNERS
. 11	NCORPORATI	ED	

SUBJECT.	RAAT	> EE,	AP	
Elec	trie	Moto	275	
DESIGNER	T.	. Tob	d	

AEP NO	290	0379	000
		OF	
DATE			

ECO# GP-B-Z INSTALL ENERGY EFFICIENT MOTORS UPON FAILURE AND FOR NEW MOTORS

A compactor spreadsheet was developed to calculate the costs, energy savings, and paybacks for motors varying from 1 hp to 300 hp. Page Z shows the calculations that are contained in the special sheet. Pages 3 through 8 are printents of the Spreadsheet on a per unit basis for hours of operation previous from 8 hr/day, 5 days/wh to 24 hr/day, 7 days/wh.

REYNOLDS, SMITH AND HILLS CHITECTS . ENGINEERS . PLANNERS SUBJECT RAAT ELAP ELECTRIC MOTOR ECO'S AEP NO 290 0379 000

T. TODD DESIGNER

CHECKER

ECO # GP-B-2

ENELDY-EFFICIENT MOTER INSTALLATION

UPON FAILURE & FOR NEW MOTORS

MOTORS ARE EXPLOSION PROOF FOR CLASS I GROUP D ASSIMPTIONS CLASS II, GROUPS F& G

1800 RPH, 460 VOLT, 3- PHASE

(05TS

NO ADDIL LABOR IS INCLUDED FOR REMOVAL & INSTALLATION SINCE A MOTOR WILL BE REPLACED OF INSTALLED IN BOTH CASES.

STANDARD- LUTY: MATERIAL COSTS ARE FROM RELIANCE ELECTRIC COMPANY LIST PRICES, WITH A CONTRACTORS DISCOUNT FACTOR OF 0.65 FOR STANDARD-DUTY MOTORS

TOTAL STD-DUTY COST = MAT'L × 1.045 × 1.507

ENERGY-EFFICIENT; MATERIAL COSTS FROM RELIANCE ELECTRIC COMPANY LIST PRICES, WITH A COMPRACTORS DISCOUNT FACTOR OF C. 45 TOR ENERGY-ETFICIENT MOTORS.

1CTAL ENERGY-EFF COST = MAT'L × 1.045 × 1.507

NET COST (1990\$) = TOTAL ENERGY - EFF COST - TOTAL STD-DUTY COST

SAVINGS = MOTOR HP x 0.746 KW x \[ \frac{1}{5-D NOM, EFF.} = \frac{1}{E-E NOM, EFF.} \] \times \frac{HPS}{VR} \times \frac{\$\times 0.03026}{KWH}

= \$ | YR

FAYEACK = NET COUT (\$) = 1000 SAVINGS/\$/YE)

											1	****		
HOTOR SIZE	RELIANCE STD DUTY EXP-PROOF	RELIANCE ENERGY-EFF. EXP-PROOF	REL JANCE STD DUTY EXP-PROOF	REL JANCE ENERGY-EFF. Exp-proof	RELIANCE STO DUTY EXP-PROOF	RELIANCE ENERGY-EFF. EXP-PROOF	3 S. F.	RELIANCE STO NOTOR NON. EFF.	RELIANCE EXP-PR XE NIN EFF.	RELIANCE EXP-PR XE NOM EFF.	ENERGY	REDUCED	COST SAVINGS	SIMPLE
	(\$8661)	(\$8661)	(19661)	(18661)	(18861)	(18861)			į	(3)	(KWH/YR)	(KB)	(\$/YR)	(YRS
-	512	1 1 1 1	333		524		74.81				168		S	57.
	546		355		559	855	75.5%				243	-	7	40.3
7	578		376		592		78.51	٠			228	<del>.</del>	1	5
ന	536		348		549						9/9	e.	28	17.
v:	85		380		238						<b>9</b> 38	<b>.</b> 3	2	28.
7.5	754		164		172						925	9.5	53	17.
=	88		575		985						946	9.5	29	19.
2	1186	1617	171	1213	1214	1918	82.51	85.51	91.87	27.16	1841	6.9	26	12.
<b>58</b>	140		916		1433						2291	=	53	12.
12	1746		1131		1781						2351	1:	11	÷
8	2004		1383		2051						2545	1.2	11	Ė
4	2727		1773		2791						3821	1.8	116	53
	3282		2133		3368						3124	1.5	95	<u>æ</u>
3	4659		3428		4769						4697	2.3	142	16.
75	5708		3710		5843						6219	3.1	161	÷
3	7041		4577		7287						9377	4.5	284	15.
125	3696	_	5912		9318						12579	9.9	38	12.
15	10/01		9269		18954						11873	5.7	328	Ξ.
288	12597		8188		12895						11166	5,3	336	<b>58</b>
258	1546		18638		15888						11201	5.4	339	24.

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT NOTORS ARE EXPLOSION-PROOF, 1888 RPM, 468 VOLT, 3 PHASE SAVINGS = HP \* 0.746\*[(1/ST NDM EFF)-(1/EE NDM EFF)] \* HRS/YR \* ELECOST

8 HRS/DAY 5 DAYS/WK =

OPERATING TIMES:

2888 HRS/YR

\$8.8383 /KWH ELECTRICITY COST: AVERAGE OF ENERGY & DEMAND CHARGES

RAAP ENERGY EFFICIENT NOTOR PROJECTS

FILENANE: RNOTSE3 Date: 8 May 98

										1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			1	
	RELIANCE	RELIANCE ENERGY-CE	RELIANCE STD DITY	RELIANCE EMEDGY-EFF	RELIANCE STD DHTY	REL JANCE ENFRRY-FFF	RELIANCE STD MOTOR	RELIANCE STD NOTOR	RELIANCE EXP-PR XE	RELIANCE EXP-PR XE	ENERGY	REDUCED	1803	SIMPLE
217E 5Y	TIDO OTE	EYP-PPONE	بيا	EYP-PRANE	EYP-PROOF	EXP-PROOF				NOM EFF.	SAVINGS	DEMAND	SAVINGS	PAYBACK
	(1998\$)	(18661)	(\$8661)	(18861)	(18861)	(\$8661)				. (2)	(KWH/YR)	(KH)	(\$/YR)	(YRS)
-	512	! ! ! !	333		524				82.51		236		7	40.8
	546		355		558				84.07	_	341		=	28.
7	578	760	376	578	592	868	78.51	81.51	85.51	86.51	383		•	32.
m	536		348		548				87.51		941	<b>.</b> 3	28	12.
יט	285		38	•	865				87.5%		895	6.3	27	±.
7.5	754		498		17.5				89.51		1337	6.5	48	12.
=	88		575		306				89.51		1328	6.5	7	13.5
2	1186	1617	171		1214				10.16		2584	6.9	78	8
28	1486		916		1433				21.12		3216	Ξ	97	æ
25	174		1131		18/1				91.72		3366	=	=	=
38	2004		1363		2021				92.41		3573	1.2	<b>8</b>	=
=	7777		1773		2791				93.61		5365		162	ġ.
5	3282		2133		3366				93.81		4386	1.5	133	12.
9	4659		3828		476				94.12		6293	2.3	288	=
75	5788		3710		5840				94.51		9152	3.1	111	=
3	7841		4577		728	_			95.6%		13163	4.5	398	6
125	5686		5912		9316				95.4%		17646	<b>9.9</b>	534	9.
25	18781		9269		1895				95.81		16668	5.7	284	
200	12597		8188	12488	1289				95.81		15583	5.3	472	<del>-</del>
258	1544		10038		1580				95.81		15725	5.4	476	17.

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT MOTORS ARE EXPLOSION-PROOF, 1800 RPM, 460 VOLT, 3 PHASE SAVINGS = HP \* 0.746\*[(1/ST NOM EFF)-(1/EE NOM EFF)] \* HRS/YR \* ELECOST OPERATING TIMES: 8 HRS/DAY

48.8383 /KWH GPERATING TIMES:

7 DAYS/WK = 2928 HRS/YR
ELECTRICITY COST: AVERAGE OF ENERGY & DEMAND CHARGES 18

RAAP ENERGY EFFICIENT NOTOR PROJECTS FILENAME: RMOTSE3 DATE: 8 MAY 98

. 90108	RELIANCE STD DUTY	RELIANCE ENERGY-EFF.	RELIANCE STD DUTY	RELIANCE ENERGY-EFF.	,	RELIANCE ENERGY-EFF.	RELIANCE STD NOTOR			RELIANCE EXP-PR XE	ENERGY	REDUCED	1503	SIMPLE
S17E (HP)	EXP-PROOF (1990\$)	EXP-PROOF (1990\$)	EXP-PROOF (1998\$)		EXP-PRO0F (1990\$)	EXP-PROOF (1990\$)	MIN. EFF.	NON. EFF.	MIN EFF.	NON EFF.	SAVINGS (KWH/YR)	DENAND (KW)	SAVINGS (\$/YR)	PAYBACK (YRS)
-	512		333		524	1	74.62				336		=	28.6
1.5	546	724	355	543	559	852	75.5%	78.5%	84.81	85.5%	485	-	15	28.2
2	578		376		592		78.51				#	-	13	23.6
က	536		348		549		75.5%				1340	.3	7	9.6
S	584		380		598						1275	<b>.</b> 3	33	10.5
7.5	754		498		172						1985	6.5	28	
=	884		575		985						1681	5.5	27	9.7
15	1186	1617	171		1214	1918					3681	6.9	Ξ	7.9
28	1486		916		1433						4582	Ξ	139	6.6
52	1746		1131		1781						4782	=	142	7.5
8	2884		1303		2051						2898	1.2	154	7.4
4	2727		1773		2791						7643	8.7	231	6.6
20	3282		2133		3360						6249	5.1	189	3.
9	4655		3028		4169						9393	2.3	284	8
75	5706		3718		5843						13038	3.1	395	7.
186	7841		4577		7207						18753	4.5	267	6.4
125	3606		5912		9316						25148	9.9	191	9.
150	10/01		9269	_	10954						23746	5.7	719	7
288	12597		818	_	12895						22288	5.3	672	
258	15443		18838	_	15888	•					22482	5.4	678	12.
900	70551	•	00411	•	27101	•					24000	0 0	376	0

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR EMERGY EFFICIENT

MOTORS ARE EXPLOSION-PROOF, 1880 RPH, 460 VOLT, 3 PHASE
SAVINGS = HP + 0.746+[(1/51 NDM EFF)-(1/EE NOM EFF)] + HRS/YR + ELECOST
OPERATING TIMES:
5 DAYS/WK = 4160 HRS/YR
ELECTRICITY COST: AVERAGE OF ENERGY + DEMAND CHARGES + 80.8383 /KWH

RAAP ENERGY EFFICIENT NOTOR PROJECTS

FILENAME: RHOTSE3 DATE: 8 MAY 98

i														
MOTOR	RELIANCE STD DNITY	RELIANCE ENERGY-EFF	RELIANCE STD DUTY	RELIANCE ENERGY-EFF.	RELIANCE STD DUTY	RELIANCE ENERGY-EFF.	RELIANCE STD NOTOR		RELIANCE EXP-PR XE	RELIANCE EXP-PR XE	ENERGY		1800	SIMPLE
_	EXP-PROOF (1990\$)	EXP-PROOF (1998\$)	1.	EXP-PROOF (19908)		EXP-PROOF (1998\$)	MIN. EFF.	NOM. EFF.	MIN EFF. (X)	NON EFF. (X)	SAVINGS (KWH/YR)	DEMAND (KW)	SAVINGS (\$/YR)	PAYBACK (YRS)
-	512		333	518	524		74.0%				471	6.1	=	20.
. 5.	546	724	355	543	559	855	75.5%	78.51	84.62	85.52	682	 	21	¥.
7	578		376	570	592		78.51				819	<b></b>	5	16.4
m	536		348	574	549		75.5%				1881	6.3	27	9
v	584		388	. 636	298						1790	6.3	24	7.
7.5	754		96+	688	772						2674	6.5	8	6.
=	88		575	928	985						2655		8	ė.
22	1186	1617	171	1213	1214	1918					5168	6.9	156	÷
78	1488		916	141	1433						6432	Ξ	195	<del>-</del>
25	1748		1131	1886	1781						6601	1:1	286	ķ
30	2884		1303	2029	2051						7146	1.2	216	ห่
=	2727		1773	2748	2791						18729	1.8	325	÷
50	3282		2133	3223	3368						8772	5	265	Ġ
9	4659		3028	4511	4169						13187	2.3	399	'n
75	2788		3710	5589	5843						18383	3.1	224	'n
9	7841		4577	8869	7287						26327	4.5	797	4.
125	9895	_	5912	9623	9316						35292	6.8	1868	<b>÷</b>
150	10/01	_	9269	18273	18954						33336	5.7	1669	'n.
286	12597	16651	8188	12488	12895						31165	5.3	943	7.
258	15443		16638	15257	15808						31450	5.4	952	æ
300	36771	•			1								27.61	•

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT MOTORS ARE EXPLOSION-PRODF, 1800 RPM, 460 VOLT, 3 PHASE SAVINGS = HP \* 0.746\*f(1/5T WON EFF)-(1/FE NON EFF)) \* HRS/YR \* ELECOST

16 HRS/DAY 7 DAYS/WK =

OPERATING TIMES:

HNX/ E020.05 7 DAYS/HK = 5848 HRS/YR ELECTRICITY COST: AVERAGE OF ENERGY & DENAND CHARGES \$8

RAAP ENERGY EFFICIENT NOTOR PROJECTS FILENAME: RNOTSE3 DATE: 8 MAY 90

	LIST PRICES	RICES	CONTRACT	CONTRACTORS PRICE	PRICES WITH	WITH MARKUPS			EFFICIENCIES	1 2 3 4 6 7 7	STANDARD	STANDARD VS ENERGY EFF CALCULATION	EFF CALCU	LATION
NOTOR	RELIANCE STO DUTY EXP-PROOF	RELIANCE ENERGY-EFF. EXP-PROOF	RELIANCE STD DUTY EXP-PROOF	RELIANCE ENERGY-EFF. EXP-PROOF	RELIANCE STD DUTY EXP-PROOF	RELIANCE ENERGY-EFF. EXP-PROOF	RELIANCE STD NOTOR NIN. EFF.	RELIANCE STD MOTOR NOM. EFF.	RELIANCE EXP-PR XE NIN EFF.	RELIANCE EXP-PR XE NDM EFF.	ENERGY	REDUCED Demand	COST SAVINGS	SIMPLE
€	(\$8661)	(\$8661)		(1888\$)	i	(18861)	i	i	į	(2)	(KWH/YR)	(KR	(\$/YR)	(YRS)
-	512		333		524		74.81				284		15	19.1
1.5	546		355		529	855	75.5%				728	<b>.</b> .	22	13.4
2	578		376		592		78.51		_		999	<b>6</b> .1	20	15.3
ന	536		348		549		75.5%				2010		61	5.8
(C)	284		380		298						1913	6.3	28	7.0
7.5	754		498		172						2857	6.5	98	5.8
=	88		575		902						2837	<b>.</b> 5	<b>9</b> 8	6.5
22	1186	5 1617	171	1213	1214	1918	82.5%	85.5%	91.87	91.72	5522	6.9	191	4.2
28	1488		916		1433						6873		588	-
22	1746		1131		1781						7053	=	213	5.0
30	2884		1303		2051						7635	1.2	231	4.9
7	2727		1773		2791						11464		347	4.4
S	3282		2133		3360						9373	1.5	<b>584</b>	9.9
9	4655		3028		4769						14898	2.3	456	5,5
75	5768		3710		5843						19557	3.1	285	8°
	7841		4577		7287	_					28130	4.5	821	4.3
125	3686	_	5912		9310	_					37769	9.9	=======================================	<b>4</b> .3
150	10761	_	9269	_	18954	_					35619	5.7	1978	8.
288	12597		8818	_	12895	_					33306	5.3	1868	6.7
258	15443		16638		15888						33684	5.4	1917	8.1
388	17726	,,	11522	_	18145						3691	5.9	1117	<b>9.4</b>

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 8.65 FOR STANDARD DUTY, 8.75 FOR ENERGY EFFICIENT

MOTORS ARE EXPLOSION-PRODF, 1800 RPM, 460 VOLT, 3 PHASE
SAVINGS = HP \* 0.746\*[(1/ST NON EFF)-(1/EE NON EFF)] \* HRS/YR \* ELECOST
OPERATING TIMES:
5 DAYS/WK = 6240 HRS/YR

58.8383 /KWH ELECTRICITY COST: AVERAGE OF ENERGY & DENAND CHARGES

RAAP ENERGY EFFICIENT MOTOR PROJECTS FILENAME: RNOTSE3 DATE: 8 MAY 98

	LIST PRICES	RICES	CONTRACT	CONTRACTORS PRICE	PRICES WITH	WITH MARKUPS	1 8 8 1 1 1 1 8 8 8	<b>3</b>	EFFICIENCIES		STANDARD	STANDARD VS ENERGY EFF CALCULATION	EFF CALCU	ATION
0101	RELIANCE CTD DUTY	RELIANCE CHERON-EFF	RELIANCE CTA DUTY	RELIANCE ENEDGY-EFF	REL JANCE	RELIANCE SNERGY-EFF.	RELIANCE STD MOTOR	RELIANCE STD NOTOR	RELIANCE EXP-PR XE	RELIANCE EXP-PR XE	ENERGY			SIMPLE
AU 100	TIDE DOLL	CNCKGI -CFF	CYD-DOUNE			FXP-PROOF	MIN. EFF.		MIN EFF.	NOM EFF.	SAVINGS	DEMAND	S	PAYBACK
(HP)	(19981)	(1990\$)	(19861)			(\$8661)	(1)	1	(3)	(1)	(KWH/YR)			(YRS)
-	615				524		74.8%				787	1.0	21	13.6
- 6	546				559		75.51				1822	 	3	9.6
	578				592	868	78.51	81.51	85.5%	86.5%	427	-	28	6.0
4 (*	536				549		75.5%				2822	.3	82	4.2
יט ני	284				598						2685	6.3	<del>8</del>	
7	754				112						=	<b>9.</b> 5	121	<b>+</b> :
	788				962						3983	5.5	121	<del>•</del> .
5	1186				1214						1152	6.9	235	3.6
. 6	1404				1433						9648	=	292	2.9
35	1748				1781						1966	-:	366	
2 8	200				2051						10719	1.2	324	3.5
, 4	272				2791						16094	æ:	487	3.1
9 6	328				3360						13159	1.5	338	÷.3
5	465			٠	4169						1978	2.3	299	3.9
75	570				5843						27455	3.	831	3.4
9					7207						39498	4.5	1195	3.
125					9318	_					52938	9.9	1602	3.
					18954						50004	5.7	1513	3.5
900					12895						46748	5.3	1415	æ. ₹
258					15888	•					47174	5.4	1427	5.8
300	17726	6 21438	11522	2 16079	18145	5321	93.81				51815	5.9	1268	<b>4</b> .6

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT

NOTORS ARE EXPLOSION-PROOF, 1888 RPN, 468 VOLT, 3 PHASE
SAVINGS = NP \* 8.746\*[(1/51 NDM EFF)-(1/EE NOM EFF)] \* HRS/YR \* ELECOST
OPERATING TIMES:
7 DAYS/WK = 8768 HRS/YR

\$8.8383 /KWH ELECTRICITY COST: AVERAGE OF ENERGY & DEMAND CHARGES

REYNOLDS.	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS · PL	ANNERS
IP.	CORPORAT	ED.	

TOBLEUB	PAAP	EEAP	
. 1	tric 1	lotors	 
DESIGNER	, T.	Tood	 

AEP NO 290 8379 000 SHEET OF 9

ECO # GP-B-3 INSTALL ENERGY EFFICIENT MOTORS RATHER

A computer spread sheet was developed to calculate the costs, energy pavings, and partacks for motors rangue from 1 hyp to 300 kg. Pages 2 & 3 show the calculations that are intained in the spreadsheet. Pages 4 through 9 are printents of the spreadsheet in a per unit taxis for hours of operation ranging from 8 h/day, 5 days /wh to 24 hr/day, 7 days /wk. REYNOLDS, SMITH AND HILLS RCHITECTS · ENGINEERS · PLANNERS

SUBJECT RAAP EEAP ELECTRIC MOTOR ECO'S DESIGNER T. TODD

AEP NO. 290 0379 000

5-1-90

ECO # GP-B-3

REWIND VS. REPLACE CALCULATION

CHECKER

#### ASSUMPTIONS

MOTORS AILE EXPLOSION- PROOF FOR CLASS I, GROUP D AND CLASSII, GROUPS F & 9

1800 RPM , 460 VOLT , 3-PHASE

ELECTRICITY COST IS AVA OF ENERGY & DEMAND CHARGES = \$ 0.03026 / KWH

COSTS NO ADDILLABOR IS INCLUDED FOR REMOVAL & INSTALLATION SINCE THIS IS THE SAME FOR BOTH REWIND AND REPLACE.

REWIND: LABOR COSTS ARE FROM ESTIMATE FROM LLOYD ELECTRIC CO., ROANOKE, VA. FOR TEFC MOTORS + 15% FOR EXPLOSION-PROOF.

> MATERIAL COSTS ARE 15% OF LATER COSTS. TO COVER BEARINGS.

TOTAL REWIND COST = (LABOR X 1.2) + (MAT'L X1.045)

X 1, 15 x 1,10 x 1,01 x 1,05 x 1,06 x 1.06

= (1.2 × LAEOR + 1.045 × MAT'L) × 1.507

REPLACE: HATERIAL COSTS ARE FROM RELIANCE ELECTRIC COMPANY LIST PRICES, WITH A CONTRACTORS DISCOUNT FACTOR OF 0.75 FOR ENERGY - EFFICIENT MOTORS.

TOTAL REPLACEMENT COST = (1.045 x MAT'L) x 1.507

NET COST()= TOTAL REPLACEMENT COST - TOTAL REWIND COST

REYNOLDS, SMITH AND HILLS ARCHITECTS · ENGINEERS · PLANNERS INCORPORATED

SUBJECT RAAT EEAP
ELECTRIC MOTOR ECO'S
DESIGNER TO TODD

AEP NO 290 03-19 000 SHEET 3 OF 9 DATE 5-1-90

E(0 # GP-B-3

#### SAVINGS

SAVINGS = MOTOR HP 
$$\times$$
 0.746 KW  $\times$   $\left[\begin{array}{c} 1\\ \text{HP} \end{array}\right]$  Standard-durty energy-efficient nominal eff. Nominal eff.  $\times$  OPERATING HRS  $\times$  \$0.03026 KWH

$$= \frac{1}{\sqrt{YR}}$$

#### PAYBACK

CHECKER

RAAP ENERGY EFFICIENT MOTOR PROJECTS

FILENAME: RHOTRR3 DATE: 8 NAY 98

SELIANCE   RELIANCE   RERENT   REDUCED   COST   RIST   R		UAIE: U MAT 30				MATT! AND	OUGAL								
FELLANCE   LLOTO   Beaching   FELLANCE   FELLANCE   FELLANCE   LLOTO   Beaching   FELLANCE   CHURON   STO MOTION   CHURON   CHU	Ξ	ST PRICE		REHIND P	RICES	PRICES WITH	MARKUPS		W.	FFICIENCIES		REPLACI	E VS REWIN	D CALCULA	TION
98         518         144         22         815         294         74.61         77.81         82.51         84.81         168.51         243         8.1         7           94         543         152         23         855         318         75.51         78.51         86.51         224         8.1         7           64         578         161         24         898         329         75.51         78.51         86.51         224         8.1         7           66         578         161         24         898         329         75.51         86.51         86.51         249         8.2         86.51         86.51         86.51         98.51         86.51         98.51         98.51         98.51         98.51         98.51         98.51         98.51         98.51         98.51         98.51         98.51         98.51         98.51         98.51         98.51         99	- 3 W	RELIANCE ERGY-EFF. KP-PROOF	RELIANCE ENERGY-EFF. EXP-PROOF	LLOYD LABOR PRICE	BEARING	RELIANCE ENERGY-EFF. EXP-PROOF	REWIND	RELIANCE STD MOTOR MIN. EFF.			RELIANCE EXP-PR XE NOM EFF.	ENERGY SAVINGS	REDUCED DEMAND		SIMPLE
543         157         22         75.5X         76.5X         86.5X         86.5X         86.5X         86.5X         86.5X         86.5X         86.5X         86.5X         86.5X         96.5X         96.5X<	1	6000		183861	20	910	700	74 PA	77 87			16.9	•	!	102 5
570         161         24         898         329         78.5X         81.5X         86.5X         228         8.1         7           636         173         26         984         353         75.5X         78.5X         86.5X         66.5X         678         8.3         28           636         198         28         1882         76.5X         78.5X         87.5X         88.5X         88.5X         88.5X         94.8         78         9.3         19           889         219         33         1471         529         88.5X         89.5X         96.2X         94.8         87.5         98.5X         94.6         8.5         29         14         81.5X         86.5X         91.6X         91.7X         94.6         8.5         29         14         82.5X         86.5X         91.6X         91.7X         94.5X         94.6X         96.5X         96.5X         96.5X         99.5X         96.5X         96.5X         99.5X         92.4X         2291         1.1         69         1.2         97.4X         92.4X		724		125	23 23	855	318	75.5%	78.57		85.5%	243	=	· _	74.2
574         173         26         984         353         75.51         78.52         89.52         89.52         67.62         67.6         6.3         28           636         198         28         18.0         75.51         75.51         87.52         87.52         67.6         6.3         9.3         19         9.2         9.5         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         9.5         19         19         19         8.5         19         19         19         8.5         19         19         19         8.5         19		766		191	54	868	329	78.51	81.51		86.51	228	<b></b>	1	85.3
636         198         28         188,01         82,51         87,51         88,51         636         8.3         19         29         23         1273         447         81,51         84,61         85,51         89,51         98,21         96,22         95,2         8.3         19           928         259         39         1461         529         87,51         89,51         98,21         96,2         95,2         8.5         29           1213         32         48         1918         658         87,51         86,51         96,71		165		173	79	<b>986</b>	353	75.5%	78.51		88.51	678	.3	28	27.2
889         219         33         1273         447         81.51         84.61         89.52         98.22         96.22         96.22         96.22         96.22         96.22         96.22         96.22         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.23         96.24         96.24         96.24         96.24         96.24         96.24         97.43         97.44         87.64         86.53         86.53         91.77         92.42         2291         1.1         69         56         96.24         96.24         93.64         96.24         97.44		848		198	28	1862	388	89.0%	82.5%		88:5%	638	6.3	<u>\$</u>	31.8
928         259         39         1461         529         82.51         85.51         96.51         96.21 <td></td> <td>1878</td> <td></td> <td>219</td> <td>33</td> <td>1273</td> <td>447</td> <td>81.52</td> <td>84.67</td> <td></td> <td>98.21</td> <td>952</td> <td>9.5</td> <td>29</td> <td>28.7</td>		1878		219	33	1273	447	81.52	84.67		98.21	952	9.5	29	28.7
1213         322         48         1918         658         82.5X         91.0X         91.7X         1841         8.9         56           1440         374         56         2268         764         84.8X         91.7X         91.7X         92.4X         2291         1.1         69           1886         431         65         2284         88.5         85.5X         91.7X         92.4X         2291         1.1         69           2029         512         77         3195         1846         86.5X         88.5X         92.4X         92.4X         2291         1.1         69           2029         512         77         3195         1846         86.5X         88.5X         92.4X         93.6X         11.1         71           2024         610         91         4315         1246         86.5X         98.5X         93.6X         31.24         1.5         77           2024         610         91         4315         1785         88.5X         92.4X         93.6X         11.6         11.6         11.6         11.6         11.6         11.6         11.6         11.6         11.6         11.6         11.6         11.6		1237		259	33	1461	529	82.51	85.5%		90.21	946	6.5	53	37.6
1446         374         56         2268         764         84.00         86.57         91.77         92.47         2291         1.1         69           1806         431         65         2844         882         85.52         87.51         91.77         92.47         2351         1.1         71           2029         512         77         3195         1046         86.52         88.57         92.47         92.47         2545         1.1         71           2740         610         91         4315         1246         86.52         88.57         92.47         93.62         125         1.1         71           3223         736         110         50.75         1246         86.52         96.21         93.62         32.62         11         71         77           5589         978         125         7103         1765         88.52         96.21         94.52         46.97         2.3         142           5589         123         147         86.75         96.21         96.21         95.02         95.02         95.02         95.02         95.02         95.02         95.02         95.02         95.02         95.02 <t< td=""><td></td><td>191</td><td></td><td>322</td><td>4</td><td>1918</td><td>658</td><td>82.5%</td><td>85.5%</td><td></td><td>21.12</td><td>1841</td><td>6.8</td><td>26</td><td>22.5</td></t<>		191		322	4	1918	658	82.5%	85.5%		21.12	1841	6.8	26	22.5
1886         431         65         2844         882         85.5x         87.5x         91.7x         92.4x         2351         1.1         71           2029         512         77         3195         1846         86.5x         88.5x         92.4x         92.4x         92.4x         2545         1.2         77           2740         610         91         4315         1246         86.5x         88.5x         92.4x         93.6x         3821         1.8         116           3223         736         110         5075         1585         88.5x         96.2x         93.6x         3124         1.5         95           4511         834         125         7103         1765         88.5x         96.2x         93.6x         31.24         1.5         95           5589         1231         147         8675         1999         88.5x         96.2x         94.5x         95.6x         87.5x         94.5x         95.6x         87.5x         146         5.9         2.3         142         4.5         2.8         146         2.3         147         86.5x         88.5x         96.2x         95.6x         95.4x         95.4x         95.4x		1926		374	38	2268	764	84.81	86.5%		92.41	2291	=	69	21.7
2629         512         77         3195         1046         86.5x         88.5x         92.4x         93.6x         2545         1.2         77           2740         610         91         4315         1246         86.5x         88.5x         93.6x         38.2t         1.8         116           3223         736         110         5075         1505         88.5x         90.2x         93.6x         3124         1.5         95           4511         834         125         7103         1705         88.5x         90.2x         94.1x         94.5x         4697         2.3         142           5509         978         147         86.75         1999         88.5x         96.2x         95.0x         95.0x         6519         3.1         197           6900         1231         185         14209         29.8         88.5x         96.2x         95.0x         95.4x		248		431	65	2844	882	85.5%	87.51		92.4%	2351	1:1	71	27.6
2740         610         91         4315         1246         86.5%         88.5%         93.6%         93.6%         3821         1.8         116           3223         736         110         5075         1505         88.5%         96.2%         93.6%         31.24         1.5         95           4511         834         125         7103         1705         88.5%         96.2%         94.1%         94.5%         4697         2.3         142           4511         834         125         7103         1705         88.5%         96.2%         94.1%         94.5%         4697         2.3         142           690         1231         143         2516         88.5%         96.2%         95.4%         95.4%         95.4%         95.4%         95.4%         95.4%         95.4%         95.4%         95.4%         95.4%         96.2%         144         96.2%         144         96.2%         144         96.2%         144         96.2%         144         96.2%         144         96.2%         110.6%         96.2%         110.6%         96.2%         110.6%         96.2%         110.6%         96.2%         110.6%         96.2%         110.6%         96.2% </td <td></td> <td>270</td> <td></td> <td>512</td> <td>11</td> <td>3195</td> <td>1046</td> <td>86.5%</td> <td>88.5%</td> <td></td> <td>93.07</td> <td>2545</td> <td>1.2</td> <td>11</td> <td>27.9</td>		270		512	11	3195	1046	86.5%	88.5%		93.07	2545	1.2	11	27.9
3223         736         110         5075         1585         88.5%         90.2%         93.6%         93.6%         3124         1.5         95           4511         834         125         7103         1705         88.5%         90.2%         94.1%         94.5%         4697         2.3         142           5509         978         147         8675         1999         88.5%         90.2%         94.5%         95.0%         6519         3.1         197           690         1231         1466         220         14209         2998         88.5%         96.2%         95.4%         95.4%         95.4%         95.4%         95.4%         95.4%         95.4%         95.4%         96.2%         380         380         380         380         380         380         380         38.6%         96.2%         96.2%         96.2%         11873         5.7         359         360         380         380         380         380         38.6%         96.2%         96.2%         96.2%         1180         5.3         336         336         33.6%         36.2%         36.2%         1180         5.3         336         33.6%         36.2%         36.2%         36.		365		610	16	4315	1246	86.5%	88.5%		93.6%	3821	8.	116	26.5
4511         834         125         7103         1705         88.5%         98.2%         94.1%         94.5%         4697         2.3         142           5509         978         147         8675         1999         88.5%         96.2%         94.5%         95.0%         6519         3.1         197           6900         1231         148         1686         2516         88.5%         96.2%         95.4%         93.7         4.5         284           9023         1466         220         14209         2998         88.5%         96.2%         95.4%         95.4%         93.7         4.5         284           10273         1754         263         16178         3586         90.2%         91.7%         95.8%         96.2%         1100         5.7         359           1248         2156         323         1967         4409         91.7%         93.0%         95.8%         96.2%         11100         5.3         336           15257         2556         383         24026         5227         93.6%         95.8%         96.2%         11201         5.4         339           16079         2956         343         96.2%		429		736	==	5075	1585	88.5%	90.21		93.61	3124	1.5	35	37.8
5589         978         147         8675         1999         88.5%         98.2%         94.5%         95.6%         6519         3.1         197           698         1231         185         1886         2516         88.5%         98.2%         95.6%         95.4%         93.7         4.5         284           9023         1466         220         14289         2998         88.5%         96.2%         95.8%         12570         6.0         389           18273         1754         263         16178         3586         90.2%         91.7%         95.8%         96.2%         11873         5.7         359           1248         2156         323         1967         4409         91.7%         93.0%         95.8%         96.2%         11100         5.3         336           15257         2556         383         24026         5227         93.6%         95.8%         96.2%         11201         5.4         339           16079         2956         443         25321         6844         93.0%         94.1%         96.2%         15303         5.9         372		691		834	125	7103	1785	88.57	98.21		94.5%	4697	2.3	142	38.6
6986         1231         185         1886         2516         88.5%         98.2%         95.4%         95.4%         9377         4.5         284           90.23         1466         228         14289         2998         88.5%         96.2%         95.4%         95.8%         15576         6.8         388           18273         1754         263         16178         3586         98.2%         91.7%         95.8%         96.2%         11873         5.7         359           12488         2156         323         19667         4469         91.7%         93.8%         95.8%         96.2%         11188         5.3         336           15257         2556         383         24026         5227         93.6%         95.8%         96.2%         11281         5.4         339           16079         2956         443         25321         6844         93.6%         94.1%         96.2%         96.2%         11281         5.9         372		7345		978	147	8675	1999	88.51	98.21		95.0%	6219	3.1	161	33.8
98.2         1466         228         14289         2988         88.5         96.2         96.2         95.4         95.8         12578         6.8         388           1673         157         263         16178         3586         90.2         91.7         95.8         96.2         11873         5.7         359           1248         2156         323         1967         4409         91.7         93.0         95.8         96.2         11100         5.3         33           1527         2556         383         2402         527         93.0         94.1         96.2         11201         5.4         339           16079         2956         443         25321         6844         93.0         94.1         96.2         96.5         12303         5.9         372		928		1231	185	18866	2516	88.5%	98.21		95.4%	9377	4.5	284	29.4
18273         1754         263         16178         3586         98.2x         91.7x         95.8x         96.2x         11873         5.7         359           1248         2156         323         1967         4409         91.7x         93.0x         95.8x         96.2x         11100         5.3         336           15257         2556         383         24026         5227         93.0x         93.6x         95.8x         96.2x         11201         5.4         339           16079         2956         443         25321         6844         93.0x         94.1x         96.2x         96.5x         12303         5.9         372		1203	_	1466	228	14289	2998	88.5%	90.2%		95.8%	12570	6.8	388	29.5
12488 2156 323 1967 4489 91.7% 93.8% 95.8% 96.2% 11188 5.3 336 15257 2556 383 24826 5227 93.8% 93.6% 95.8% 96.2% 11281 5.4 339 16879 2956 443 25321 6844 93.8% 94.1% 96.2% 95.5% 12383 5.9 372		1369		1754	263	16178	3586	98.21	21.72		96.21	11873	5.7	329	32.8
15257 2556 383 24826 5227 93.6% 93.6% 95.8% 96.2% 11281 5.4 339 16879 2956 443 25321 6844 93.6% 94.1% 96.2% 96.5% 12383 5.9 372		1665	_	2156	323	19961	4489	21.12	93.0%		96.21	11100	5.3	336	42.4
16079 2956 443 25321 6044 93.01 94.11 96.21 96.51 12303 5.9 372		2834;		2556	383	24826	5227	93.6%	93.67		96.2%	11281	5.4	339	55.5
		21438	_	2956	443	25321	6844	93.0%	94.17		15.96	12303	5.9	372	51.8

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT

MOTORS ARE EXPLOSION-PROOF, 1888 RPM, 468 VOLT, 3 PHASE SAVINGS = HP \* 8.746\*[(1/ST NON EFF)-(1/EE NON EFF)] \* HRS/YR \* ELECOST

8 HRS/DAY OPERATING TIMES:

S DAYS/MK = 2000 HRS/YR ELECTRICITY COST: AVERAGE OF ENERGY & DEHAND CHARGES \$0.0303 /KWH

RAAP ENERGY EFFICIENT MOTOR PROJECTS FILENAME: RHOTRR3 DATE: 8 MAY 98

ATE: 8 MAY 98	AAY 98													
	LIST PRICE	CONTRACTOR	REWIND PRICES	RICES	PRICES WITH	LABOR I MARKUPS		•	EFFICIENCIES		REPLACE	E VS REWIN	REPLACE VS REVIND CALCULATION	110N
MOTOR	RELIANCE	RELIANCE	TTOYD	BEARING	RELIANCE SUCDGY-EFF	REWIND	RELIANCE STD MOTOR	RELIANCE STD MOTOR	RELIANCE FYP-PR YE	RELIANCE EXP-PR XE	ENERGY	REDUCED		SIMPLE
SI 7F			PRICE	LAICE	EXP-PROOF		MIN. EFF.	NOM. EFF.	MIN EFF.	NOM EFF.	SAVINGS	DEMAND	SAVINGS	PAYBACK
(₹)		(188681)	(\$8661)	(\$8661)	(18661)	(18861)	(2)	(1)	(1)	(1)	(KWH/YR)	(KR)		(YRS)
-	969		144	22		294	74.0%				236		1	73.0
1.5	724	1 543	152	23	855	310	75.5%	78.51	84.61	85.5%	341	<b>.</b> .	81	52.8
2			191	24		329	78.51				383	-	5	8.8
m	191		173	26		353	75.5%				941	.3	78	19.4
ſΩ	848		161	28			80.81				895	8.3	11	22.7
7.5	1878		219	33			81.5%				1337	6.5	7	20.4
=	123		259	39			82.5%				1328	6.5	7	23.2
15	1617		322	#			82.51				2584	6.9	78	16.8
28	1921		374	26			84.67				3216	=	41	15.5
25	248		431	65			85.5%				3386	-:	9	19.6
8	278		512	11			86.5%				3573	1.2	88	19.9
4	365		919	91			86.5%			•	5365		162	18.9
7	429		736	==			88.51				4386	1.5	133	26.9
99	6914		834	125		1785	88.57				6233	2.3	288	27.1
75			878	147			88.51				9152	3.1	111	24.1
991			1231	195			88.5%				13163	4.5	398	21.8
125	_		1466	228		•	88.5%				17646	9.9	234	21.0
158		_	1754	263		•••	98.2%				16668	5.7	584	22.8
288			2156	323			21.12				15583	5,3	472	32.4
258			2556	383			93.61				15725	5.4	476	39.5
300	21438	16079	2956	443	1 25321	6844	93.6%				17272	5.9	523	36.9

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT

MOTORS ARE EXPLOSION-PROOF, 1800 RPM, 460 VOLT, 3 PHASE SAVINGS = HP \* 0.746\*[(1/ST NOM EFF)-(1/EE NOM EFF)] \* HRS/YR \* ELECOST

8 HRS/DAY

OPERATING TIMES:

18.8383 /KHH T DAYS/WK = 2920 HRS/YR ELECTRICITY COST: AVERAGE OF ENERGY & DEMAND CHARGES 60.6

jane a sue

RAAP ENERGY EFFICIENT NOTOR PROJECTS FILENAME: RNOTRR3 Date: 8 may 98

IE: 0 MAI 30	96				MATTI	AND 1 AROP								
_	LIST PRICE	CONTRACTOR	REWIND PRICES	RICES	32	ITH MARKUPS			EFFICIENCIES	. !	REPLACE	REPLACE VS REWIND CALCULATION	D CALCULA	NOL
0	RELIANCE	RELIANCE	11.070	BEARING	REL JANCE	REWIND	RELIANCE STD MOTOD	RELIANCE	RELIANCE	KELIANCE EYP-PR XE	ENERGY			SIMPLE
SIZE	EXP-PROOF		PRICE	1	EXP-PROOF		MIN. EFF.			NOM EFF.	SAVINGS	9	SAVINGS	PAYBACK
(€	(18861)	(18861)	(18861)	(1998)	(1888)	(\$8661)	(3)	(2)	(2)	(2)	(KWH/TK)	(KN)	CN/TK)	(TK3)
-	<b>8</b> 69	518	#	7	22 81	5 294	74.81		82.5%	84.0%	336		•	51.3
1.5	724	543	152	2	23 855	5 310	75.5%	78.51	84.87	85.51	485		12	37.1
7	16		191	2			78.51		85.5%		448		13	42.7
ı m	765		173	2	26 984		75.57				1348	<b></b>	7	13.6
כאי	848	929	198	2			80.87				1275	<b>9</b> .3	33	15.9
7.5	1678		219	(43			81.5%				1985	9.5	28	14.3
=	1237		259	(T)			82.51				1881	6.5	21	16.3
15	191	_	322	•			82.5%				3681	6.8	Ξ	11.2
20	1926		374		56 226		84.0%				4582	=	139	8.8
25	2486		431	9			85.5%				4782	1:1	142	13.8
8	2765	2829	512	-	77 3195	5 1846	86.51	88.5%	92.4%		2898	1.2	124	13.9
4	365		619		91 431		86.5%				7643	1.8	231	13.3
i de	429		736	=	110 507		88.51				6249	5	183	18.9
9	189		834	77			88.5%				9393	2.3	284	19.6
75	7345	5 5589	978	-		5 1999	88.51				13038	3.1	395	6.9
3	9288		1231	31	_	•	88.53				18753	÷	267	14.7
125	12838		1466	27			88.57				25146	9.9	761	14.7
25	13697	_	1754	77			98.23				23746	2.7	719	17.5
298	16651		2156	3,			17.16				22288	5.3	672	22.7
258	2834		2556	ਲ	83 24826	16 5227	93.6%				22482	5.4	8/9	27.7
386	21438		2956	÷	443 2532	•	93.6%				24686	5.9	745	25.9

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 0.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT

MOTORS ARE EXPLOSION-PROOF, 1888 RPM, 468 VOLT, 3 PHASE SAVINGS = HP \* 8.746\*[(1/ST NON EFF)-(1/EE NON EFF)] \* HRS/YR \* ELECOST

OPERATING TIMES: 16 HRS/DAY

16 HRS/DAY 5 DAYS/WK = 4160 HRS/VR

ELECTRICITY COST: AVERAGE OF ENERGY & DEHAND CHARGES \$0.0303 /KWH

9233 2729

RAAP ENERGY EFFICIENT NOTOR PROJECTS FILENAME: RNOTRR3 Date: 8 may 90

					MAT'L AND	LABOR								
	LIST PRICE	CONTRACTOR	RENIND PRICES	RICES	PRICES WITH	I MARKUPS			EFFICIENCIES		REPLAC	REPLACE VS REWIND CALCULATION	D CALCULA	NOIL
	REL I ANCE	REL IANCE	0,077	1 45	REL LANCE	REWIND	RELIANCE	REL JANCE	RELIANCE	REL I ANCE				
M0108	•	u	LABOR	PRICE	ENERGY-EFF.			STD MOTOR	EXP-PR XE	EXP-PR XE	ENERGY	REDUCED	1503	SIMPLE
SIZE	E EXP-PROOF	EXP-PROOF	PRICE		EXP-PROOF			NOM. EFF.	MIN EFF.	NON EFF.	SAVINGS	DENAND	SAVINES	PAYBACK
<b>€</b>	(18861)	(\$8661)	(18861)	(\$8661)	(1888)	(\$8661)		(2)	(1)	(1)	(KWH/YR)	(KE)	(\$/YR)	(YRS)
	169		¥.	22	815	767	74.02	77.0%			471		=	36.5
1.5			152	23	852	318	75.5%				682	<b>9</b> .	21	26.4
			191	24	868	329	78.57				618	=	61	30.4
	3 765		173	36	186	353	75.5%				1881	<b>.</b> 3	21	9.1
	5 848		196	28	1902	388	18.81				1798	.3	Š	11.3
7.	5 1078	_	219	33	1273	447	81.57				2674	6.5	8	10.2
-	1237		259	39		529	82.51				2655	6.5	8	9.11
-	5 1617		322	48		658	82.5%				2168	6.9	126	æ.
7	1926		374	36		764	84.8%				6432	=	195	1.1
7	5 2486		431	65	2844	882	85.5%				1899	=	200	8. 8.
i es	2765		512	11	3195	1846	86.5%				7146	1.2	216	9.6
•			618	16	4315	1246	86.5%				10729	8.	325	9.5
S			736	•==	5875	1505	88.51				8112	1.5	565	13.5
•			834	125		1785	88.5%				13187	2.3	399	13.5
7			978	147.		1999	88.5%				18303	3.1	554	13.1
-			1231	185		2516	88.51				26327	4.5	197	10.5
12	_	9023	1466	228	14289	2998	88.51		95.41	95.81	35292	9.9	1068	10.5
2		_	1754	263		3286	98.21				33336	2.1	1009	12.5
28			2156	323		4489	27.12				31165	5,3	943	16.2
25			2556	383		5227	93.0%				31450	5.4	925	19.8
300	21438	B 16079	2956	+43		9944	93.01				34544	5.9	1845	18.4

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 8.65 FOR STANDARD DUTY, 8.75 FOR ENERGY EFFICIENT

NOTORS ARE EXPLOSION-PROOF, 1846 RPM, 460 VOLT, 3 PHASE SAVINGS = HP \* 0.746\*[(1/ST NOM EFF)-(1/EE NOM EFF)] \* HRS/YR \* ELECOST

16 HRS/DAY
7 DAYS/UK = 50

OPERATING TINES:

7 DAYS/WK = 5849 HRS/YR

ELECTRICITY COST: AVERAGE OF ENERGY & DEMAND CHARGES \$8.8383 /KUH

GREET PROFE

FILENAME: RMOT DATE: 8 MAY 98	FILENANE: RNOTRR3 Date: 8 may 98									٠				
	LIST PRICE	CONTRACTOR	REWIND PRICES	RICES	MAT'L AND LABOR PRICES WITH MARKUF	LABOR MARKUPS		u	EFFICIENCIES		REPLACE	VS REWIN	REPLACE VS REWIND CALCULATION	NO11
MOTOR 2175	RELIANCE MOTOR ENERGY-EFF.	RELIANCE ENERGY-EFF.	LLOYD LABOR	BEARING	RELIANCE ENERGY-EFF.	REWIND	RELIANCE STD MOTOR	STD NOTOR	RELIANCE EXP-PR XE MIN FF	RELIANCE EXP-PR XE NON FFF.	ENERGY	REDUCED	COST	SIMPLE
(¥)		(1998)	(19981)	(\$8661)	(1998)	(\$8661)	(7)		(1)	(1)	(KWH/YR)	(KH)		(YRS)
	869	518	#1	22	815	294	74.0%	77.01	82.5%	84.8%	584		15	34.2
1.5			152	23	855	310	75.5%	78.51		85.5%	728	9.1	22	24.7
2			191	24	888	329	78.5%	81.51		86.5%	999	<del>.</del>	<b>58</b>	28.4
m	165		173	36	984	353	75.5%	78.51	87.51	88.5%	2010	.3	19	9.1
S			190	28	1992	388	86.0%	82.51			1913	e. •	28	10.6
7.5	_		219	33	1273	447	81.5%	84.8%			2857	6.5	98	9.6
9			259	33	1461	529	82.51	85.5%			2837	6.5	<b>98</b>	10.9
51	161	_	322	48	1918	628	82.51				2255	6.9	167	7.5
28	1920		374	26	2268	764	84.8%				6873	-:	208	7.2
72			431	65	2844	882	85.5%				7853	-:	213	9.5
38			512	11	3195	1846	86.51				7635	1.2	231	9.3
4	3653	3 2748	619	16	4315	1246	86.5%				11464	1.8	347	8.8
			736	110	5875	1585	88.5%				9373	.5	284	12.6
99			834	125	7183	1785	88.5%				14898	2.3	426	12.7
75	5 7345		978	147	8675	1999	88.51	90.21			19557	3.1	285	11.3
961			1231	185	10866	2516	88.5%	98.2%			28139	4.5	821	9.8
125			1466	228	14289	2998	88.51				37709	9.9	=======================================	9.8
158		-	1754	263	16178	3586	98.2%	91.72	95.81		32619	5.7	1078	11.7
286			2156	323	19861	4489	21.72				33388	5,3	1868	12.1
258			2556	383	24826	5227	93.8%		95.8%		33684	5.4	1017	18.5
300	21438	_	2956	. 443	25321	6844	93.6%				36910	5.9	1117	17.3

RAAP ENERGY EFFICIENT NOTOR PROJECTS

ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR = 8.65 FOR STANDARD DUTY, 0.75 FOR ENERGY EFFICIENT

MOTORS ARE EXPLOSION-PROOF, 1800 RPM, 460 VOLT, 3 PHASE SAVINGS = HP \* 0.746\*[(1/ST NON EFF)-(1/EE NON EFF)] \* HRS/YR \* ELECOST

146\*1(1/3) NUM EFF7-(1/EE NUM EFF7) \* NA 24 HRS/DAY

OPERATING TIMES:

5 DAYS/WK = 6248 HRS/YR ELECTRICITY COST: AVERAGE OF ENERGY & DEMAND CHARGES \$8.0303 /KWH

RAAP ENERGY EFFICIENT MOTOR PROJECTS FILENAME: RMOTRR3 DATE: 8 MAY 98

		. 8	- -	e	S.	7.6	8.9	1.1	5,3	5.2	6.5	9.9	6.3	9.6	<b>9.</b> 6	8.8	7.0	7.0	8.3	8.9		67.3 67.3	- 1		,	, *	F. F	
REPLACE VS REWIND CALCULATION	SIMPLE PAYBACK (YRS)	24.3	17.6																		_	_						
	COST SAVINGS (\$/YR)	21	31	28	92	8	121	121	235	292	388	354	487	398	299	83	1195	1602	1513	1415	1427	1568						
	REDUCED DEMAND (KW)		-		.3	6.3	6.5	9.5	6.	Ξ	-:	1.2	8.	1.5	2.3	3.1	4.5	9.9	5.7	5.3	5.4	5.9			•			
	ENERGY SAVINGS (KWH/YR)	787	1822	927	2822	2685	191	3983	1752	9648	1866	10719	16094	13159	1978	27455	39498	52938	58884	46748	47174	51815						
	RELIANCE EXP-PR XE NON EFF. (X)	84.87	85.5%	86.5%	88.51	88.5%	90.2%	90.21	21.12	92.4%	92.4%	93.0%	93.6%	33.62	94.5%	95.6%	95.4%	95.81	96.21	96.21	96.21	36.51						
EFFICIENCIES	RELIANCE EXP-PR IE E NIN EFF. (X)	82.5%	84.0%	85.51	87.51	87.5%	89.5%	89.5%	91.61	21.12	21.72	92.42	93.61	93.0%	94.12	94.5%	95.0%	95.41	95.81	95.8%	95.8%	96.21						
	RELIANCE STD NOTOR 6 NOM. EFF.	77.0%	78.51	81.51	78.5%	82.5%	84.8%	85.5%	85.5%	86.51	87.5%	88.51	88.5%	98.2%	98.2%	98.21	98.2%	. 98.2%	27.12	93.0%	93.6%	94.1%						
	RELIANCE STD HOTOR NIN. EFF.	74.6%	75.5%	78.51	75.5%	86.67	81.5%	82.51	82.51	84.07	85.51	86.5%	86.5%	88.51	88.5%	88.5%	88.5%	88.51	98.2%	21.72	93.8%	93.0%	FOR ENERGY EFFICIENT					
MAT'L AND LABOR PRICES WITH MARKUPS	REWIND (1998s)	294	310	329	353	388	447	529	628	764	882	1046	1246	1202	1705	1999	2516	2998	3586	4489	5227	6844			1503		KAH	
	RELIANCE ENERGY-EFF. EXP-PROOF (1990\$)	815	855	868	984	1802	1273	1461	1918	2268	2844	3195	4315	5015	7103	8675	18866	14289	16178	19961	24826	25321	ASSUMPTIONS: CONTRACTORS DISCOUNT FACTOR ≈ B.65 FOR STANDARD BUTY. B.75	3	NON EFF)-(1/EE NON EFF)] # HRS/YR * ELECOST		8768 HRS/YR Arges \$0.8303 /KWH	
REWIND PRICES	BEARING PRICE (1990\$)	22	23	75	36	28	33	33	<b>4</b>	56	. 65	11	5	118	125	147	185	228	263	323	383	+	8.65 FOR STA	JOLT. 3 PHAS	NON EFF) 1		8768 NAND CHARGES	
	LLOYD LABOR PRICE (1998\$)	#	152	191	173	861	219	259	322	374	431	512	619	736	834	978	1231	1466	1754	2156	2556	2956	T FACTOR = 6	1888 RPM. 468 VOLT. 3 PHASE	EFF)-(1/EE	24 HRS/DAY	7 DAYS/WK = 8768   AVERAGE OF ENERGY & DEMAND CHARGES	
CONTRACTOR	RELIANCE ENERGY-EFF. EXP-PROOF (1998\$)	518	543	570	574	636	608	828	1213	1440	1886	2029	2748	3223	4511	5209	8869	9823	18273	12488	15257	16879	TORS DISCOUN	N-PROOF. 180		24	AVERAGE OF	
LIST PRICE	RELIANCE ENERGY-EFF. EXP-PROOF (19908)	<b>9</b> 69	724	160	765	848	1078	1237	1617	1928	2488	2705	3653	4297	<b>6014</b>	7345	9288	12938	13697	16651	20342	21438	MS: CONTRAC	MOTORS ARE EXPLOSION-PROOF.	SAVINGS = HP + 0.746+[(1/S]	OPERATING TIMES:	ELECTRICITY COST:	
_	NOTOR SIZE (HP)	-	1.5	2	ന	כט	7.5	=	12	<b>58</b>	25	<b>.</b>	40	20	89	75	188	125	150	288	258	388	OTTAMUS	OTORS A	AVINGS	PERATIN	LECTRIC	

		A STR NO
REYNOLDS, SMITH AND HILLS RCHITECTS · ENGINEERS · PLANNERS INCORPORATED	DESIGNER PF.H CHECKER	SHEET OF DATE DATE
Eco # GP-	B-4	
Install vario	ble fræguency driver i	n main
1. Calculate cu	rrent energy use	
Current pro lurbine pun 1-400 hp la aurent aver Average usage Turbine pun	opposite is to operate up plus 1-100 hp deep ooster pump in combinate is 24 m about 12 million go	1-600 hp nation. The illin gal/da. l/da
	s. amps. v3 /1000	
= 230	0.127.15/1000 =	506 KW
Deep well	pump:	
10 WD = 2	300·23·13/1000 =	92 kW
Booster pu	mp	
kWB = Z	200-130. 13/1000 =	495 kW

Average annual usage = 1093.3760 = 9.574,680 kWhAverage annual cost =  $9,574,680 \times 0.03 = $1287,240$ (current usage (WB+n) =  $9,574,680 \times 3413 = 32,678 \text{ m/5+n}$ 

Total hW = 506+92+495 = 1093 kW

REYNOLDS, SMITH AND HILLS

2. Calculate every savings

Calculate septem head for following current

ehp= 1093 kW

 $n_p = 0.70$   $n_m = 0.95$  Q = 24,000,000 gal/da = 16,667 gpm

ehp = bhp/nm

 $kW = 0.75 \times ehp$ 

bhp = whp/np

ehp = kw/0.75

ehp = whp/nm/np

whp = H.Q 3960

 $ehp = \frac{H \cdot Q}{3960 \cdot \eta_P \cdot \eta_m} = \frac{kW}{0.75}$ 

= <u>kw.3960.7p.nm</u> Q.0.75

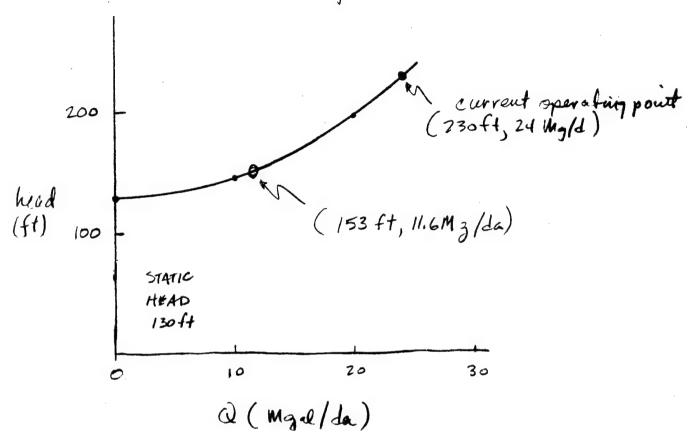
1093 · 3960 · 0.70 · 0.95

H = 230 feet

Assume static heat is about 150 feet.

	SUBJECT	AEP NO
EYNOLDS, SMITH AND HILLS		SHEET OF OF
	DESIGNER	DATE
INCORPORATED		

Water Plant System Jurue



Eximple = current use - rurrent \* new hoad sold hoad

= current use 
$$\left(1 - \frac{H_n}{H_0}\right)$$

= 32,678 MBtu  $\left(1 - \frac{153}{230}\right)$  = 10,940 MBtu (electricity)

# Project No. <u>290-0379-000</u> (904) 281-0394

Telephone Gall reynolds, smith and hills

Local_F	> Hutch Washinghe	L.D. Lins Dure Ela	PlacedConver	Rec'd—Rec'd—rsed with <u>Mark</u> egarding <u>Variable</u>	Date 5/29/90 Riffle Frequency Drives
	MR ga	ve bu	dget extimat	es for variable	speed drives
	600	hp	\$ 2000	# 60,000	
	450	•	\$ 2000	\$ 40,000	
	(00	hp	\$ 2000	\$ 12,000	
					·
					· ·
Distr	ibution:				

CONSTRUCTION COST		DATE PREPARED		1	SHEET	o <b>r</b>		
ENERGY ENGINEERING		BASIS FOR ESTIMATE						
RADFORD ARMY AMMUN	ITION F	PLANT			CODE & (Preliminary design)  CODE C (Final design)  OTHER (Specify)			
ARCHITECT ENGINEER								
REYNOLDS, SMITH AND	HILLS	A.E.	P., []	NC.		CHECKED		
ECO# GP-B-	4	E311m	P.	Hutchins	>	CALGALO	-	
VARIABLE SPEED SUMMARY	QUANT	ITY		LASOR		MATERIAL		TOTAL
DRIVES	NO. UNITS	UNIT	UNIT	TOTAL	UNIT	TOTA		COST
1-600 hp VSD	1	ea		2000		60,0	00	62,000
1-400 hp VSD		ea		2 000		40,0	000	42,000
1-100 hp VSD	. (	ea		2000		12,0	000	14,000
Subtotal			-	6000		112,0	000	118,000
Solos Tay (4.5%)						50		5040
FICA/Ins. (20%)		,		1200				1200
Subtotal .				7200		117,	040	124,240
Overhead (15%)								18,636
Prnf.+ (10%)								14,288
cond (1%)								1572
Harades Support (60%)								9524
(ontingency (10%)								16826
								1
Construction Cost								1135,086
							=	
								·
				•				
lendor quete	West a	righ	our					
)								

## ECO # GP-D-1 INERT GAS SYSTEM Replacement

SAVINGS FROM CAPTURING HEAT & GENERATING STEAM
(40 pris)

PERMEA ESTIMATES 1800 L85, STEAM/ARFROM 60,000 CFH UNIT. Steam pavings are:

1800 185/HR X 1175.9 BTU/LB X 8760 = 18,542 Mbtu/yr.

Cool savings: 18,542 Metus x 1.32 Metus = 24,475 Mistulyr 24,475 Metu = \$39,405/Yr

Electricity Purchase Penalty: 18,542 \* 0.111 \* 6.87 = \$ 18,256/yr.

Reduced Power House O'EM:

18,542 motus x 1.01/motus = #18,727/xv

Non Ruergy Savings = \$18,727-18,256 = \$471/yr

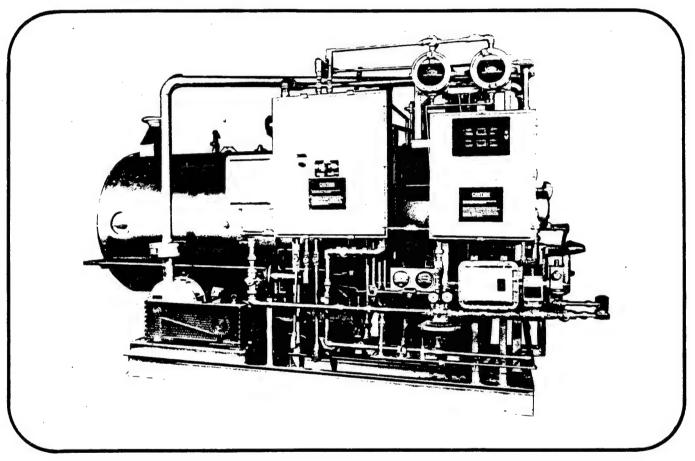
CONSTRUCTION COST		DATE PREPARED SHEET / OF							
ENERGY ENGINEERING	ANALYS	IS			BASIS FOR ESTIMATE				
RADFORD ARMY AMMUNITION PLANT						CODE A (No design completed)  CODE S (Preliminary design)			
ARCHITECT ENGINEER REYNOLDS, SMITH AND	א ווזון כ	ΛΕ	D [1	אור <u>'</u>		- THER (Spa		nign).	
DRAWING NO.	HILLS	ESTIM	ATOR			CHECKE	D BYKA		
	QUANT		FALL	UN/		MATERIA		<u> </u>	
SUMMARY	NO. ÚNITS	UNIT MEAS.	PER	TOTAL	PER	TO		TOTAL COST	
INERT GAS GEN/BOILER		ea s	2400	2400	177,000	17	7,000	180,000	
TAX 4,5%						,	7,965	7,965	
		-							
FICA TINSURANCE 20%				600				600	
		'					•	188,565	
SUB POTAL									
OVERHEAD 15%							•	28,284	
SUB TOTAL				,				216,850	
PROFIT 10%								21,685	
SUB TOTAL								238,535	
BOND 1%								2.385	
SUB TOTAL								240920	
CONTINGENCY 7,5%	L.,							18,069	
SUBTOTAL								258,989	
Hercules 6.0%						.•	•	15,539	
SUBTOTAL .								274,528	
							·		

# Count on KEMP for

## COGENERATION

Kemp ERG—the energy recovery generator for plant processes requiring inert gas and steam or nitrogen and steam.

This ERG qualifies for a 10% tax credit if applied to P.L. #96-223 for waste heat recovery.



### For Inert/Nitrogen Generation

The Kemp ERG System will produce inert or nitrogen gas. It is the result of Kemp's unique handcrafted nozzle mix burner system that promotes the complete reaction of air and fuel.

#### For Steam Generation

The Kemp ERG offers "two for one" use of your fuel! The boiler is sized with your inert gas requirements

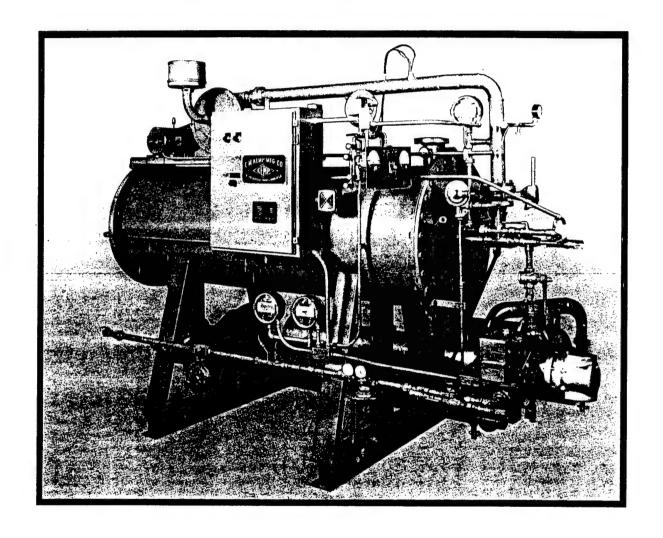
in mind but has an efficiency rating of over 80%. The residual steam is rated at 150 PSIG or can be provided in other pressures on request. Such high efficiency provides great advantages over conventional systems:

- Accelerated payback—half the normal capital equipment time span.
- Lower water requirements—75% less than a standard generator.
- Percentage tax depreciation and waste heat credit.





## PH Series Inert Gas Generators



- Low Cost Inert Gas
- High Purity
- Simplified Installation
- Indirect Cooling

## HunTer

## **Telephone Call Confirmation**

			Project No c	290-0379	-000
Local	_ L.D	Placed _	Rec'd	<u>ک</u> Date	-22-90
		Conversed	With DALE	JALKS	
Of PERME (7/3) 68	A ZNC. 34-0438	Regai	rding /NERT 6	AS GEN.	
NEW					
60,000	ACFH I	GG WILL	PROPUEE	1800 LBS	STEAM HA
TOUR	COST 2	\$200,000	MSTALLED.		
		\$177,000	DELIVERED	1,747,144	
20,000	ACFH ~	\$100,000	INSTALLED	DELIVERED	-
		600 ppH.			
		· •			
			•		
			·		
					· · · · · · · · · · · · · · · · · · ·
Distribution:					

HUNTER Form 102

RSH.	DESIGNER G, FALLON CHECKER	SHEET / OF / DATE /0-19-90 DATE
GP-D-2 RE	DUCE STACK TEMPERATUR	2 <b>E</b>
	CHX DATA ATTACHE	
	NERBY RECOVERED (SAVE	
26.8	MBTI/HR x 8030 Hygr. =	215,204 MBTU/4n
	AL COST SAYEO	
815,204	MBTU/yrx \$1.61/mBTU =	\$346,478 /yr.
A Doit in a	F1.55	

ADDITIONIAL ELECTRICITY REQUIRED

34 HP x.746 x 8030 = 203673 KWh 203673 KWN x #0.03026/KWR = 6163

NET SAVINGS

\$ 346,478/yr-\$6163/yr = \$340315/yr =>\$349000

COMPANY LOCATION HRS PROPOSAL NO. REPRESENTATIVE PROPOSAL STATUS APPLICATION BOILER NAMEPLATE RATING HERCULES - RAAF RADFORD, VA 820-02 PEL YEAR JCJ PRELIMINARY

AUGUST 20, 1990 HEAT BOILER MAKEUP WATER & 510,000 LBS/HOUR

CASE 1 OF 5

HRS SYSTEM MODEL # 3-416-160 DW 7 CHAMBIER OF THE STEAM BOAD

DESIGN PARAMETERS

AVERAGE STEAMLOAD FOR CASE	225,000	LBS/HOUR
AVAILABLE FLUE GAS MASS	331,239	LBS/HOUR
BOILER FEEDWATER TEMPERATURE	268.0	DEGREES F.
STEAM PRESSURE ( 750 DEG. F)	400	PSIG
EXCESS COMBUSTION AIR	30.00	PERCENT
FLUE GAS TEMP & SOURCE	350.0	DEGREES F.
MAXIMUM WATERFLOW AVAILABLE TO HX	718	GAL/MIN
FLUE GAS WATER VAPOR DEWPOINT	102.6	DEGREES F.
FLUE GAS DENSITY	0.0523	LBS/CU.FT.
SPECIFIC HEAT OF FLUE GAS	0.2504	
HOURS OF OPERATION FOR CASE	2920 T	HOURS/YEAR ;
FUEL FIRED	The second second	COAL
FUEL COST	\$1.60	DOLLARS/MM BTU
EXISTING FUEL TO STEAM EFFICIENCY	85.74	PERCENT
EXISTING THERMAL EFFICIENCY	87.32	PERCENT

#### HEAT EXCHANGER PERFORMANCE

FLUE GAS MASS FLOW @ HX INLET	331,239	LBS/HOUR
FLUE GAS FLOW & INLET TO HX	105,472	ACFM
FLUE GAS INLET TEMP	350.0	DEGREES F.
FLUE GAS OUTLET TEMPERATURE	102.3	DEGREES F.
WATERFLOW THROUGH HX	405.0	GAL/MIN
WATER INLET TEMPERATURE	55.0	DEGREES F.
WATER OUTLET TEMPERATURE	187.6	DEGREES F.
SENSIBLE HEAT RECOVERED	20,545,662	BTUS/HOUR
LATENT HEAT RECOVERED	6.251.306	BTUSZHOUR_
TOTAL HEAT RECOVERY		HEARIC PRINCIPLE
SAVINGS FOR THIS CASE	A STATE OF THE STA	4000年12日本

#### ENGINEERING DATA

NEW BOILER FUEL TO STEAM EFFICIENCY NEW THERMAL EFFICIENCY EFFICIENCY INCREASE FUEL SAVINGS WATERSIDE PRESSURE DROP THEORETICAL FAN POWER HEAT EXCHANGER FLUE GAS PRESSURE DROP PLENUM, DUCT AND BREECHING LOSS CONDENSATE FLOW RATE

94.60 PERCENT THE PLAN PERCENT 10.33 2.97 PSIG. 0.25 IN. W.C. 12.2 GAL/MIN

COAL ANALYSIS USED FOR THIS CASE %H2 2N2 **%02** %S %H20 %ASH 75.00 5.00 2.30 1.50 6.70 2.50 7.00 13000



## Condensing Heat Exchanger Corp.

Route 7, Drawer H • Warnerville, N.Y. 12187 • (518) 234-2541

August 20, 1990

Mr. Steven L. DeBusk Industrial Engineer Hercules - RAAP P.O. Box 1 Radford, VA 24141

Dear Steve.

The enclosed performance printouts are divided into 3 groups; low, medium and high, to represent possible production requirements, with 5 cases in each group to represent firing levels at different times of the year or times of the day. Because the CHX Condensing Economizer is normally installed as a slip stream device and therefore can be sized for the heat duty rather than the nameplate capacity of the boilers, the heat exchanger size for the "low" scenario is smaller than the model we originally discussed and the size for "medium and high" is larger than the original.

The preliminary size choice for the "low" condition is a CHX Model 2-416-120 DW7 which would generate net energy savings of about \$306,000 per year. The current budget equipment cost estimate for this size is \$725,000. The "medium and high" condition would require a CHX Model 3-416-160 DW7. The current budget equipment cost estimate for this size is \$1,250,000. The "medium" condition would generate net energy savings of \$531,000. The "high" condition net savings would be \$596,000.

If particulate emission reduction is a major factor in the evaluation of this energy recovery project, the equipment configuration and subsiquent performance can be optimized to generate more condensate flow which will improve removal efficiency. This would probably increase the pay-back period. Another method to enhance removal efficiency is to spray additional water into the heat exchanger. This would reduce energy recovery slightly.

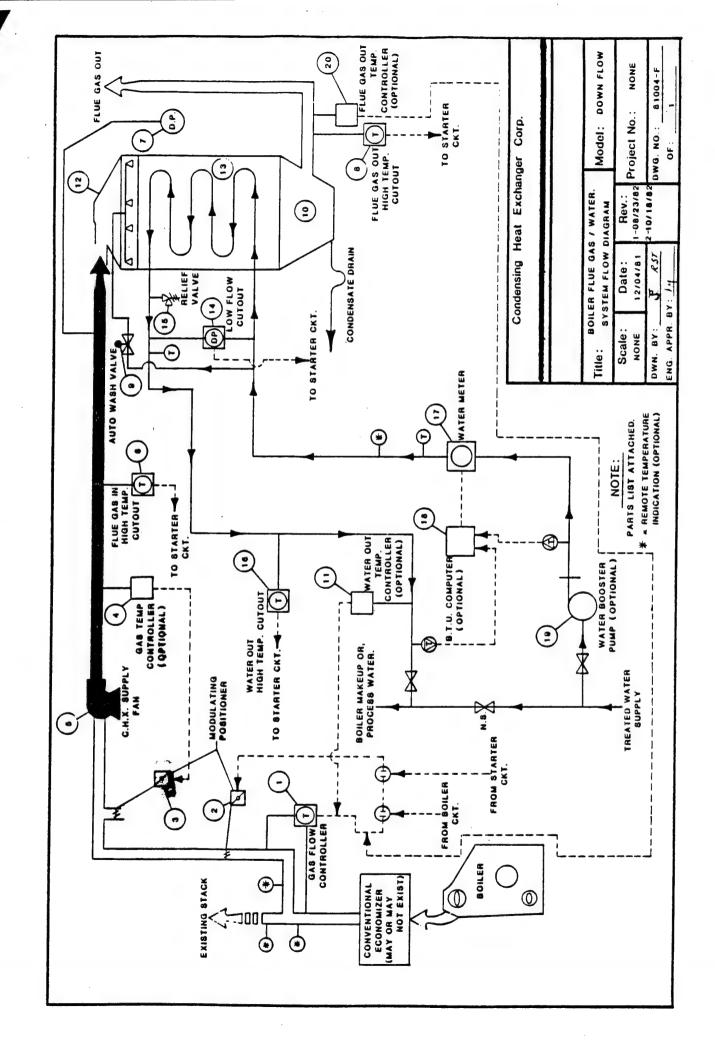
I will call you next week to further discuss this possible energy recovery/particulate removal project.

Very tryly yours,

(=15) 798- 9637

John C. Joseph

Dir Applications Engineering



CONSTRUCTION COST ESTIMATE				DATE PREPARED			SHEET	OF	
PROJECT	PROJECT ENERGY ENGINEERING ANALYSIS						OR ESTIM		
LOCATION	RADFORD AAP, RADFORD					CODE A (No design on		design)	
ARCHITECT	REYNOLDS, SMITH AN				•	1	] CODE C	(Final de ecily)	• i (m)
DRAWING NO				ATOR	GWF	1	CHECKE	DBY	1
0-1/2	= \0. \0	QUANT	ITY	T	LABOR		MATERIA	4,	
HEAT	EXCHANGER	NO. UNITS	UNIT MEAS,	PER	TOTAL	PER	TO	TAL	COST
- TICAL	EXCUMNUE IC								
HEAT	EXCHANGER				725,000		725	,000	1, 450,000
					'				
		<u> </u>							
1	HIS AMOUNT				the mar		S		
<u> </u>	SINCE IT IS			i					
	FURTHER	BICEA	KL	BWI	uis incl	LUDE	D.		
<u> </u>									
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EYNOLDS, SMITH AND HILLS RCHITECTS • ENGINEERS • PLANNERS INCORPORATED	DESIGNER TOT	Lighting Project: odd	SHEET 1	
	NCANDESCENTS SION-PROOF A		HPS SCREW.	-INS FOR
Calculations were m	rade on a	per-unit basi	's for insta	lling
35 W HPS "units"	within the	existing explor	Lion Joob	
incandescent fixture	. These unit	is consist of a	HPS lamp an	
a ballast with a me	dium tase a	dapter which	sciens into	the
incondescent Accept.	the per-unit	Colculations a	ie on page	2,
From the building su	wey dots, a	hat was compr	led of the	
buildings with polenting only areas with higher It is assumed that	al incardescenting operating 30% of the in	t lighting pro 3 shoults Iday 50 Jenior and 50°	days I who were	3). considered,
fixtures (an he retroti	Hed in the 1	manner describe	k above for-	this ECO.
Total fixtures = Energy savings = 674 Energy cost savings = 674 Labor d math cost savin	0.9(1536 kwh/yr × 0.0 \$20.39 x 17. yr-fixture	) + 0.5(717) 03413 MBH/kwh x 40 fixtures =	= 1240	4003 HEtu/u
Total cost savings =	\$35479 f	\$ 30346 = \$6	5,825/yr	•
Project cost = \$80 fi (Construction cost	cture \$140.00	fixtures = \$14	0,000 25,561)	
Simple payback = 1				

EYNOLDS, SMITH AND HILLS RCHITECTS + ENGINEERS + PLANNERS INCORPORATED	SUBJECT RAAP Lighting Project Screening Calcs. DESIGNER Todd	AEP NO 290 0379 000 SHEET 2 OF 10 DATE DATE
GP-N-1 Replace intler screw-in retra	of 150-200W incardescents fits for explosion-proof applications	with 35 W HPS slications *
	(150 W- 42 W) x 24 hr x day	
Energy Cost Savings.	= 674 kwh 10.03026 =	\$20.39 yr
Labor & Mat'l Cost San	rings = / Includ, Cost _ HPS ( 750 hr 16000	ost ) x 6240 hr yr
717	70 labor × 0.683 x 1.2 ap- grt) (\$16 0 hm 6240 hr = \$17.44 yr \$17.44	matl + \$6.45 labor x 0,683x1.2) 16,000 hr
Total lost savings =  Mod'l cost = \$45	$\frac{$10.39}{yv} + \frac{$37.83}{yv}$	(1990 Alador into.)
and the state of t	× 1.20 × 1.20 exp-proof × 0.68.	2 = \$1.18 Pacing exp-proof inconf, +20%
Project Cost=[ Simple payback	$(1.045 \times $45) + (1.2 \times $45)$ = \$80.46 = 2.1 u \$37.83/yy	1.18) ×1.661 = +80.46
Note: HPS lamps a	re replaceable in the retro	fit ballasts.

RSH	-
	Ð

SUBJECT	A	EP NO		
	SI	HEET	OF	
DESIGNER	D.	ATE		
CHECKER	D	ATE		

## QRIP Celcis

Current energy use for 1740 lamps: 150 W \* 24 \* 260 \* 0.03026 \* 1740 = \$\frac{4}{49,280/yr}\$

Current matil ; labor costs:

· 2.11 +1.2 x 0.68x12x 6240 x 1740 = # 44, 181/yr

Current labor costs

1.2 × 0.68 × 6240 × 1740 = # 11,813/y-

New energy use

42W x 24 x 260 x 0,03026 x 1740 = # 13,799/Jr

New matil & labor costs:

16 + 6.45 + 0.68 × 1.2 × 6240 × 1740 = #14,429/yr

New labor costs

6.45 × 0.68 × 1.2 × 6240 × 1740 = #3572/y-

### Radford Army Ammunition Plant List of Buildings with Incandescent Lighting

Bldg No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
1000 -00	Cotton Linter Warehouse	NC, A&B-Line	1	17	17
1606 -00	Open Tank Air Dry	Sol. Recovery, A-Line	10	20	200
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	27	- 12	324
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	20	60
	SG Curing Hse Carpet Rolls		10	5	50
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	1	6	6
7106 -04	Dry House #4 (Cure Grain)	1st R P	7.	8	. 56
9334 -15	Blender House	4th Rolled Powder	1	4	4
TOTAL FOR	EXTERIOR FIXTURES				717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
	Boiling Tub House		3	50	150
	Beater House		3	40	120
	Poacher & Blending House		3	30	90
3513 -00	C-1 Press & Cutting House	Green, C-Line		50	150
4912 -40	Forced Air Dry House	Pilot B	21	10	210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	1	4	4
	Small Grain Mold Assembly		1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
	TOW Launch Saw House		1	8	8
5008 -01	15 Inch Press House	Pilot A	3	2	6
6304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	600
TOTAL FOR	R INTERIOR FIXTURES				1536

CONSTRUCTION COST	ESTIMAT	ΓE		DATE PREPARED 6-9	0		SHEET	4 of 10
ENERGY ENGINEERING	ANALYS	IS				OR ESTIM		
RADFORD ARMY AMMUNITION PLANT					00E 8 (P	reliminary d	-	
ARCHITECT ENGINEER	UTILIC	Λ Ε	ז מ	NC		] CODE 0 THER (\$p	: (Final des ecity)	ign)
REYNOLDS, SMITH AND	) HILLS	ESTIM.	ATOR			CHECKE	Ye O	
GP-N-1			T. T				. 1	
Incaud to 35 WHE SUMMARY	NO.	UNIT	PER	TOTAL	PER	TO	TAL	TOTAL COST
Replace incandescent	1740	fixt.	1.18	2053	45.00	7	8300	80 353
lamps with 35 W HFS								
scrow-in retrofits								
Sales Tax	4.5%						3524	3524
FICA/ Insurance	20,0%	,		411				411.
Subtotal				2464		8	1824	84288
Overhead	15.0%							12643
Profit	10.0%							9693
Performance Bond	1.0%							1066
Heraites Support	60%							6461
Contingency	10.0%							11415
construction Cost								125566
	•							
			-					
					}			

GPN-1 p. 5 of 10

ECP ENERGY CONSERVATION PRODUCTS, 511 CANAL STREET, NYC, NY, 10013-TEL (212)-925-5991

#### POWER CONSUMPTION AND LUMEN CUTPUT DATA

	223232				
-0		TOTAL	LUMENS	HOURS OF	*
* WATTS	LINE WATTS	LIMEN CUTPUT	PER WATT	RATED LIFE	*
	Y VAPOR (DELUXI		50	24000	*
* 1000	1075	63000	59 56	24000 24000	*
* 400	450	23000	56		
* 250	290	13000	42	24000 24000	*
* 175	205	8500	49 42	24000	*
* 100	120	4500			*
* 75	93	3150 1680	37 31	16000 16000	*
* 50	61 	1000			
****** METAL	HALIDE				*
* 1500	1600	155000	103	3000	*
* 1000	1100	110000	100	12000	*
* 400	460	34000	85	15000	*
* 175	210	14000	85	7500	*
*******	PRESSURE SODIUM				*
* 1000	1080	140000	130	24000	*
* 400	480	50000	104	24000	*
* 250	310	27500	89	24000	*
* 150	200	16000	80	24000	*
* 100	135	9500	70	24000	*
		5800	68	24000	*
<sup>70</sup> 50	25 70	4000	57	24000	*
* 735)	(42)	2850	67	18000	*
***************************************	~~				*
*******FWORES	SCENT,				*
STRAIGHT 40	48	3150	66	20000+	*
CIRCLINE 32	37	1830	50	12000+	*
CIRCLINE 22	25	1050	42	12000+	*
CIRCLINE 20	23	850	37	12000+	*
TWIN TUBE 13	16	900	56	10000+	*
TWIN TUBE 9	12	600	50	10000+	<b>π</b>
STRAIGHT 8	11	400	36	7500+	*
TWIN TUBE 7	10	400	40	10000+	-
STRAIGHT 6	9	300	33	7500+	
TWIN TUBE 5	8	250	31	10000+	
****** INCAN	DESCENT				*
1000	1000	23740	24	1000	*
* 750	750	17040	23	1000	*
* 500	500	10850	22	1000	*
* 200	200	3710	19	750	*
* (150)	150	2880	19	<b>(750)</b>	*
* 100	100	1750	18	750	*
* 75	75	1190	16	750	
*****	S—IODINF.			**********	*
1500	15J0	35800	24	3000	**************************************
* 1000	1000	23400	23	2000	*
* 500	500	10950	22	2600	*
* 250	250	4850	19	2000	***************************************

24,000

12

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	CASE CITY
	RT FLUORESCE			



#### 12,000 12 FB40/U6/CW/EW 2,600 FB40/U6/CW 2,950 12,000 12



#### INSTANT START SLIMLINE FLUORESCENT LAMPS

F72T12/CW F96T12/CW/EW F96T12/CW
--



#### HIGH & VERY HIGH OUTPUT FLUORESCENT LAMPS

111011 - 10111 111011				
F96T12/CW/H0/EW	95	8,300	12,000	15
F96T12/CW/H0	110	9,200	12,000	15
F96T12/CW/VHO/EW	185	14,000	12,000	15
F96T12/CW/VH0	215	15,500	12,000	15



#### METAL HALIDE UNIVERSAL BURN MEDIUM BASE LAMPS

		1		- 10
MH35/U	35	2,300	5,000	12
MH50/U	50	3,400	5,000	12
MH70/U	70	5,500	5.000	12
MH100/U	100	7,200	7,500	12
MH150/U	150	12,000	10,000	12



#### METAL HALIDE UNIVERSAL BURN MOGAL BASE LAMPS

MH175/U	175	14.000	10.000	12
MH175/C/U	175	14.000	10.000	12
MH250/U	250	20,500 .	10,000	12
MH250/C/U	250	20,500	10,000	.12
MH400/U	400	36,000	20,000	6
MH400/C/U	400	36,000	20,000	6
MH1000/U	1000	110,000	12,000	6
MH1000/C/U	1000	105,000	12,000	6



#### COMPACT DOUBLE ENDED HO! METAL HALIDE LAMPS

HQI 70	70	5,000	10.000	12	Į
HQI 150	150	11,000	10,000	12	-
HQI 250	250	19,000	10,000	12	ĺ
HQI 400	400	25,000	10,000	12	1



## HIGH PRESSURE SODIUM MEDIUM BASE LAMPS

	LU35/MED	35	2.250	(16.000)	12	- 11
-	LU35/D/MED	35	2,150	16.000	12	- 11
	LU50/MED	50	4.000	24,000	12	
	LU50/D/MED	50	3,800	24,000	12	
	LU70/MED	70	6,300	24,000	12	
	LU70/D/MED	70	5.985	24,000	12	
	LU100/MED	100	9,500	24.000	12	
	LU100/D/MED	100	8.800	24,000	12	
	LU150/MED	150	16,000	24,000	12	
	LU150/D/MED	150	15,000	24,000	12	
						_



#### COLOR IMPROVED HIGH PRESSURE SODIUM LAMP

002011 11111 1101				
NHT50SDX	50	2,500	12.000	12



#### HIGH PRESSURE SODIUM ED-231/2 MOGUL BASE LAMPS

HIGH I HEGODILE				
LU50	50	4,000	24.000	12
LU50/D	50	3,800	24.000	12
LU70	70	6.300	24.000	12
LU70/D	70	5.985	24,000	12
LU100	100	9.500	24.000	12
LU100/D	100	8.800	24.000	12
LU150/55	150	16,000	24.000	12
LU150/55/D	150	15.000	24,000	12



LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE CITY
HIGH PRESSU	RE SODIUM	E-18 MOGL	IL BASE LA	MPS
LU200	200	22,000	24,000	12
LU250	250	29,000	24,000	12
LU250/D	250	26,000	24,000	12
LU310	310	37,000	24.000	12

50,000



#### LOW PRESSURE SODIUM LAMPS

LU400

SOX10 SOX18 SOX35 SOX55	10 18 35 55	1,000 1,800 4,800 8,000	9,000 14,000 18,000 18,000	20 20 12 9
SOX90	90	13.500	18,000 18,000	9
S0X135 S0X180	135	22.500 33,000	18,000	9



#### WILLIAM THE AMERICAN THE OCCUPANT AND

MR16 LUW VULIA	SE 124 1	UNG21EN H	ALUGEN L	MILO
ESX (N)	20	3,300	2,000	20
BAB (W)	20	460	2.000	20
EYR (N)	42	7,300	2,000	20
EYS (M)	42	2,500	2,000	20
EYP (W)	42	1,200	2,000	20
EXT (N)	50	9,150	3.000	20
EXZ (M)	50	3.000	3.000	20
EXN (W)	50	1.500	3,000	20
EYF (N)	75	11,500	3,500	20
EYJ (M)	75	4.500	3,500	20
EVC (M)	75	2.000	3.500	20



### MR16 LINE VOLTAGE 120V MEDIUM BASE

	IUNGSIEN HALL	GEN LAM	ro			
	M/JDR75W/N	75	6,300	2,000	12	
	M/JDR75W/M	75	3,500	2.000	12	
	M/JDR75W/W	75	2,100	2,000	12	
	M/JDR100/N	100	8.500	2,000	12	
7	M/JDR100/M	100	4.500	2,000	12	
•	M/JDR100/W	100	3.000	2.000	12	



## MR16 LINE VOLTAGE 120V INTERMEDIATE BASE TUNGSTEN HALOGEN LAMPS

I/JDR75W/N I/JDR75W/M I/JDR75W/W I/JDR100/N I/JDR100/M	75 75 75 100 100	6,300 3,500 2,100 8,500 4,500	2.000 2.000 2.000 2.000 2.000	12 12 12 12 12	
I/JDR100/W	100	3,000	2.000	12	



## TUNGSTEN HALOGEN LINE VOLTAGE MEDIUM BASE

I UBULAH LAM	75				_
64484/CL	75	1.200	2.000	15	
64484/FR	75	1.140	2.000	15	1
64486/CL	100	1.600	2,000	15	
64486/FB	100	1.520	2.000	15	
64488/CL	150	2.760	2,000	15	
C4400/ED	150	2 622	2 000	15	1



## TUNGSTEN HALOGEN LINE VOLTAGE DOUBLE ENDED LAMPS

DOODLE EMDED	LAIMIT 3				
Q100T3/CL Q150T3/CL Q200T3/CL Q300T3/CL Q500T3/CL	100 150 200 300 500	1.600 2.800 3.600 6.000 11.000 33.000	200 200 200 200 200 200	12 12 12 12 12 12 12	



BROOKLYN, NEW YORK

TEL. (800) 552-3465

(718) 851-4577

FAX (718) 853-2390

	0.400   111-141		DAILY	MAN-			BARE			TOTAL
16	66 100   Lighting	CREV	VOUTPUT	HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL OEP
1600	90 watt	1 Ek	c .30	26.670	C-	5,140	645		5,785	6,600
1650	135 watt		.20	40		6,905	970		7,875	9,025
1700	180 watt		.20	40		7,308	970		8,278	9,475
1750	Quartz line, clear, 500 watt		1.10	7.270		1,872	175		2,047	2,325
1760	1500 watt		.20	40		3,427	970		4,397	5,200
1800	Incandescent, interior, A21, 100 watt		1.60	5		173	120		293	370
1900	A21, 150 watt		1.60	5		(211)	120		331	410
2000	A23, 200 watt		1.60	5		227	120		347	430
2200	PS 30, 300 watt		1.60	5		330	120		450	540
2210	PS 35, 500 watt( )		1.60	5		576	120		696	810
2230	PS 52, 1000 watt		1.30	6.150		1,525	150		1,675	1,900
2240	PS 52, 1500 watt		1.30	6.150		2,382	150		2,532	2,850
2300	R30, 75 watt		1.30	6.150		375	150		525	630
2400	R40, 150 watt		1.30	6.150		408	150		558	670
2500	Exterior, PAR 38, 75 watt		1.30	6.150		566	150		716	840
2600	PAR 38, 150 watt		1.30	6.150	-	525	150		675	795
2700	PAR 46, 200 watt		1.10	7.270		1,928	175		2,103	2,375
2800	PAR 56, 300 watt		1.10	7.270		2,193	175		2,368	2,675
3000	Guards, fluorescent lamp, 4' long		1	8		375	195		570	695
3200	8' long	1	.90	8.890		535	215		750	905
0010	RESIDENTIAL FIXTURES									
0400	Fluorescent, interior, surface, circline, 32 watt & 40 watt	1 Ek	c 20	.400	Ea.	48	9.70		57.70	67
0500	2' x 2', two U 40 watt		8	1		66	24		90	110
0700	Shallow under cabinet, two 20 watt		16	.500		45	12.15		57.15	67
0900	Wall mounted, 41, one 40 watt, with baffle		10	.800		41	19.40		60.40	74
200	Incandescent, exterior lantern, wall mounted, 60 watt		16	.500		36	12.15		48.15	57
00	Post light, 150W, with 7' post	1	4	2		104	49		153	185
2500	Lamp holder, weatherproof with 150W PAR		16	.500		16	12.15		28.15	35
2550	With reflector and guard		12	.667		31	16.15		47.15	58
2600	Interior pendent, globe with shade, 150 watt		20	.400		78	9.70		87.70	100
0010	TRACK LIGHTING	+								
0080	- 1 4 1 14 14 14 14 14 14 14 14 14 14 14	1 5	6.70	1.190	Ea.	33	29		62	79
0100	Track, 1 circuit, 4' section  8' section  12' section	T	5.30	1.510		48	37		85	105
0200	12' section		4.40	1.820		81	44	İ	125	155
0300	3 circuits, 4' section		6.70	1.190		36	29		65	82
0400	8' section		5.30	1.510		48	37	<u> </u>	85	105
0500	8' section 12' section Feed kit, surface mounting	1	4.40	1.820		88	44		132	160
1000	Feed kit, surface mounting		16	.500		12	12.15		24.15	31
	End cover	+	24	.333		1.98	8.10		10.08	14.0
1100	Feed kit, stem mounting, 1 circuit		16	.500		16	12.15	1	28.15	
1200	3 circuit	1	16	.500		16	12.15	<del></del>	28.15	
1300	Electrical joiner for continuous runs, 1 circuit		32	.250		6.55			12.60	•
2000		+	32	.250	1	12.10			18.15	
2100	3 circuit		16	.500		47	12.15	1	59, 15	
2200	Fixtures, spotlight, 150 PAR	+	16	.500		101	12.15		113.15	
3000	Wall washer, 250 watt tungsten halogen		16	.500		102	12.15	1	114.15	
3100	Low voltage, 15% watt, 1 circuit  3 circuit	$\rightarrow$	16	.500	1	109	12.15		121.15	

400	6 100 Lighting	1		DAILY	MAN-		1007		COSTS EQUIP.	TOTAL	TOTAL INCL OAP	
100		CRE	_	OUTPUT	HOURS	UNIT	MAT.	LABOR	EUUIP.	503	565	13
5100	175 watt metal halide	1 E	lec :	8	!	Ea.	479 500	24 24		524	585	1"
5110	250 watt metal halide	+	-	8		_	535	24		559	625	1
5120	150 watt high pressure sodium			8	1		556	24		580	645	ı
5130	250 watt high pressure sodium	+		8			525	24		549	615	t
5140	72"H 18" sq., 400 watt metal halide			8	1		556	24	}	580	645	ı
5150	250 watt high pressure sodium			8	-1-		581	24		605	675	1
5160	400 watt high pressure sodium	١,	1	8	1	. •	361			•••	0.0	ı
5190	Portable rectangle, 6" high 13.5" x 20"	1.5	laa	12	.667	Ea.	293	16.15		309.15	345	1
5200	175 watt metal halide	1 5	100	12	.667	Ja.	314	16.15		330.15	370	ı
5210	250 watt metal halide	1			.667		335	16.15		351,15	390	1
5220	150 watt high pressure sodium			12 12	.667		360	16.15		376.15	420	ı
5230	250 watt high pressure sodium			12	.667		365	16.15		381.15	425	1
5240	8" high 18" x 24", 400 watt metal halide			12	.667		376	16.15		392.15	435	ı
5250	250 watt high pressure sodium	+-	_	12	.667		398	16.15		414.15	460	1
5260	400 watt high pressure sodium			12	.667		324	16.15		340.15	380	ı
5270	Portable square, 15" high 13.5" sq., 175 watt metal halide				.667		376	16.15		392.15	435	1
5280	250 watt metal halide			12	.667		360	16.15		376.15	420	ı
5290	150 watt high pressure sodium		_	12	.667	-	386	16.15		402.15	450	1
5300	250 watt high pressure sodium			3.20	2.500		355	61		416	480	ı
5400	Pendent 16" round/square, 175 watt metal halide		-	2.70	2.960		370	72		442	515	1
5410	250 watt metal halide			2.40	3.330		398	81		479	555	1
5420	400 watt metal halide 150 watt high pressure sodium	+	_	3.20	2.500		398	61		459	525	1
5430	250 watt high pressure sodium	1		2.70	2.960		428	72		500	575	١
5440 5450	400 watt high pressure accium		_	2.40	3.330		454	81		535	620	1
0010 L	AMP8 Fluorescent, rapid start, cool white, 2' long, 20 watt	1 6	lec	1_	8	С	348	195		543	670	
0100	4' long. 40 watt			.90	8.890		198	215		413	535	١
0120	3' long, 30 watt			.90	8.890		442	215		657	805	1
0150	U-40 watt	$\top$		.80	10		874	245		1,119	1,325	ı
0170	4' long, 35 watt energy saver			.90	8.890		270	215		485	615	4
0200	Slimline, 4' long, 40 watt			.90	8.890	1 1	618	215		833	995	١
0300	8' long, 75 watt			.80	10		577	245		822	990	4
0350	8' long, 60 watt energy saver			.80	10		603	245		848	1,025	١
0400	High output, 4' long, 60 watt			.90	8.890		750	215		965	1,150	4
0500	8' long, 110 watt			.80	10		775	245		1,020	1,200	١
0520	Very high output, 4' long, 110 watt	Ĺ		.90	8.890	$\sqcup$	1,285	215		1,500	1,725	4
0550	8' long, 215 watt			.70	11.430	1 1	1,285	275		1,560	1,825	1
0600	Mercury vapor, mogul base, deluxe white, 100 watt			.30	26.670		2,142	645		2.787	3,300	4
0650	175 watt	1		.30	26.670		1,663	645		2,308	2,775	١
0700	250 watt			.30	26.670	_	2,968	645	<u> </u>	3,613	4,225	4
0800	400 watt			.30	26.670	4	2,340	645		2,985	3,525	۱
0900	1000 watt		L	.20	40	$\bot \bot$	5,100	970		6,070	7,025	4
1000	Metal halide, mogul base, 175 watt			.30	26.670		3,749	645		4,394	5,075	ı
1100	250 watt		_	.30	26.670	_	4,712	645		5,357	6,125	4
1200	400 watt			.30	26.670	1	4,386	645		5,031	5,775	
1300	1000 watt		+	.20	40	++	9,894	970	+	10,864	12,300	4
1320	1000 watt, 125,000 initial lumens			.20	40		9,960	970	1	10,930	11,600	
1330	1500 watt	$\perp$	_	.20	40	+-	9.268	970		5,357	6,125	4
1350	Sodium high pressure, 70 watt	1		.30	26.670		4,712	645		5,516	6,300	
860	100 watt		1	.30	26.670		4,871	645		5,704	6,525	$\dashv$
370	150 watt			.30	26.670		5,059	645		1	6,875	1
1380	250 watt		-	.30	26.670		5,380	645	+	6,025	7,250	4
1400	400 watt			.30	26.670		5,727	645		14,322	16,100	١
1450	1000 watt		+	.20	40	+	13,352	970	+	4,608	5,300	٦
1500	Low pressure, 35 watt			.30	26.670		3,963	645		5,031	5,775	
	55 watt		1	.30	26.670	1 E	4,386	645		, ,,,,,,	3,770	

21

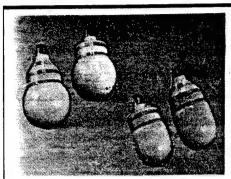
## HunTen

# (7P-N-1 7 9 of 10 Telephone Call Confirmation:

	Project No. 290 0379 000
(716) LocalLD. <u>851-4577</u>	Placed Rec'd Date 6-7-90
of American Scientific Light	Conversed With Mr. Singer  ting Co. Regarding HPS retrotits
OI MATERIAL STATES	J
For retrofits of incande	scent fixtures, the "Bulb Lumenight"
and "Colorlight" product	Is are recommended. The lamps are  rd the "colorlight" is more whitish.  uding lamp) for quantities of 100+
replaceable in both a	od the "colorlight" is more whitish.
Contractors costs (incl	uding lamp ) for quantities of 100+
are as follows:	
Bulb Lumenight	35 W - \$45 / lamps only
Ú	35 W - \$45 (lamps only) 50 W - \$45 (\$16-\$20)
(also come i	~ 70 W 100 W 150 W)
Colorlight	50W - \$67 (lamps only \$30)
	<sup>()</sup> ≠ 30 )
They will send a cox	oy of their rotalog for dimensions.
Distribution:	



## FLUOR-A-LAMP<sup>TM</sup> SERIES: COMPACT FLUORESCENT LAMPS

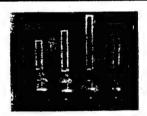


#### GLOBE LAMP/LUMA LAMP

- LAMP: Compact disposable fluorescent globe or tubular lamp/standard or tapered base
- WATTAGE: Fifteen
- LUMENS: 720
- COLOR: Warm white/2800k
- USE: Indoor only
- . BURNING POSITION: Any
- · LAMP LIFE: 9,000 hours
- INSTALLATION: Screws into any 120V medium base socket
- PACKAGING: Ten lamps per master carton

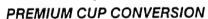
CATALOG NUMBER	LAMP	DIMENSIONS
FGL S/15	BFG15 LE/A	Lamp Diameter 3¾** Overall Length 6¼**
FGL T/15	BFG15 LE/T	Lamp Diameter 3¾1
FLL S/15	BFT15 LE/A	Overall Length 63/4" Lamp Diameter 31/6"
e Tue	DET45   5.5	Overall Length 6%"
FLL T/15	BFT15 LE/T	Lamp Diameter 31/s' Overall Length 7"

CONVERT-A-LITE™ SERIES: SCREW-IN FLUORESCENT ADAPTER CONVERSIONS



#### **ECONOMY CUP CONVERSION**

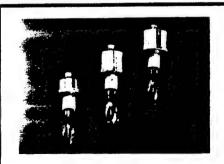
- ADAPTER: Molded Norei<sup>®</sup> thermal plastic/Sealed and potted to protect internal components
- FINISH: White
- . LAMP: Centered on top of adapter/Not dimmable
- INSTALLATION: Adapter screws into any standard 120v medium based socket/No additional wiring or modified circuitry required
- · PACKAGING: Bulk packed/Lamp included



- ADAPTER: Molded Norel® thermal plastic/Sealed to protect internal components
- . FINISH: Black
- LAMP: Centered/Recessed inside of adapter/Not dimmable
- INSTALLATION: Adapter screws into any standard 120v medium base socket/No additional wring or modified circultry required/Ratched screw base prevents over tightening
- PACKAGING: Bulk packed/Lamp included

CATALOG LAMP NUMBER		DIMENSIONS
		Adapter Diameter 21/6"
CC/5/E	PL5	Overall Length 636"
CC/7/E	PL7	Overall Length 71/2"
CC/9/E	PL9	Overall Length 8%"
CC/13/E	PL13 Overali Le	Overall Length 91%,"
CC/Q9/E	Quad 9	Overall Length 65%"
CC/Q13/E	Quad 13	Overall Length 7"
CATALOG NUMBER	LAMP	DIMENSIONS
		Adapter Diameter 2¾"
CC/5/P	PL5	Overall Length 51/2"
CC/7/P	PL7	Overall Length 61%6"
CC/9/P	PL9	Overall Length 8"
CC/13/P	PL13	Overall Length 81%,"
CC/Q9/P	QUAD 9	Overall Length 5%"
		Overall Length 61/4"
CC/Q13/P	QUAD 13	Overall Length 6%
CC/Q13/P CC/Q22/P	QUAD 13 QUAD 22	Overall Length 8%"
		•

CONVERT-A-LITETM SERIES: SCREW-IN HPS ADAPTER CONVERSIONS



#### BULB LUMENIGHT™

- ADAPTER: Heavy gauge spun aluminum
- FINISH: Caustic etching
- INSTALLATION: Adapter screws into a standard 120V medium base porcelin socket/No additional wiring or modified circuitry required/Safety weight ground wire
- . PACKAGING: Four per carton/Lamp included

CATALOG NUMBER	LAMP	DIMENSIONS		
8L/35 BL/50	LU35 LU50	Diameter 31/s" Overall Length 93/s"		
BL/70	LU70	Diameter 31/4" Overall Length 10 1/16		
BL/100 BL/150	LU100 LU150	Diameter 4" Overall Length 101/8"	,	
	ay Reflector ly Reflector	DW Direct Wire		

AMERICAN SCIENTIFIC LIGHTING CORPORATION

BROOKLYN, NEW YORK

TEL. (800) 522-3465

718) 851-4577

·FAX (718) 853-2390

	BUBJECT RAMP Lighting Projects	AEP NO 190 0379 060
EYNOLDS, SMITH AND HILLS ICHITECTS · ENGINEERS · PLANNERS INCORPORATED	DESIGNER T. TODA	SHEET OF DATE
GP-N-2 REPLACE	INCANDESCENTS WITH CIRCLII	ne fluorescents
Calculations were made	on a per unit basis for in	italling 32 W
circline fluorescent fi	Atures in place of incendes	ents for
	or proof applications. The	
	page 2. From the building	
	with potential incombescen	
was compiled (page	3). It is assumed for this	ECO that
10% of the interior	festures ere non-explosion	proof and can
be retrofolded in the	is manher. Only areas operating 3 5	histo lay, 5 days I who were considered
Total fixtures =	0.1 × 1536 = 154	
Energy Sourings = 7	05 Rush x 0.003413 MEtu x 154	f = 371 MBtu/gr
Energy cost savings	0.5 Rush x 0.003413 MEtu x 154  gv kurb  = \$21.34 x 154 fixtures = \$  yr-fixture	3286 lyr
Mayl & labor cost si	wings = \$20.33 × 154 = \$	3131 Jyr
Total cost saving	5 = 3286 + 313 = \$641	7/yr
Project cost = \$ 9.	4.47 , 15+ = +14,548 cture	
	ost= 14,548/1.115 = \$13,0	48)
Simple payback =	\$14,548 = 2.3 yr   \$6417/yr	

YNOLDS, SMITH AND HILLS CHITECTS • ENGINEERS • PLANNERS INCORPORATED	SCHEEN T.	Lighting Pi Lighting Pi Lood Lood		NO 290 (	
GP-N-2 Replace interior	100-150W in	candescents	with 32	W screw	in
fluorescent for	xtures for	non-explo	sion proof	applica	ations
				00	
- Assume original li	ant levels	should not	be reduced	Significa	utly.
(32 W fluor. p	nordes lume	an outfut de-	tween 1000	v and 10	ow incens
				:	
Energy savings = (	150W-37W	24 6	260 Agus =	705	twith
The ray swings -		day	yr		yv
			0		
Energy cost savings = 7	705 Kwh	F0.03 026	= \$21.34		
William	4+	kush	yr		
	U	:	O		
Labor & mat'l cost s	avings = /I	neard cost	Fluor cost	× 6240	hr
		750 hr	12000 hr		45
= ( \$2.11 met! + 750	Ar		12,000 6240 hr	hr	
		*			v
Total cost savings	= \$21.34 yr +	\$20.33 =	141.67 yr		
Total cost savings		#20.33 =	#41.67 yr		<b>Y</b>
		#20.33 =	#41.67 yr		<b>Y</b>
		#20.33 =	#41.67 yr		<b>Y</b>
Mat'l cost = \$42.	90 for fixtus \$5.55 for la	+20.33 = gr e x 1.10 in mb x 1.10 in	$\frac{141.67}{yv}$ If at ion (198) $f(1) = $35$	34 vendor 3.30	- li tevati
Mat'l 40st = \$42.	90 for fixtus \$5.55 for la	+20.33 = gr e x 1.10 in mb x 1.10 in	$\frac{141.67}{yv}$ If at ion (198) $f(1) = $35$	34 vendor 3.30	- li tevati
Mat'l cost = \$42. + Labor cost = \$1,20	90 for fixtur \$5.55 for le x 1.20 x 0	#20.33 = gr e x 1.10 in mp x 1.10 in	$\frac{$41.67}{yv}$ If at ion (198 $f1. = $53$ of replacing	34 vendor 3.30	- literati bulb + 20c
Mat'l cost = \$42. + Labor cost = \$1,20	90 for fixtur \$5.55 for le x 1.20 x 0	#20.33 = gr e x 1.10 in mp x 1.10 in	$\frac{$41.67}{yv}$ If at ion (198 $f1. = $53$ of replacing	34 vendor 3.30	- literati bulb + 20c
Madil cost = \$42.  tabor cost = \$1,20  Project cost = [	90 for fixture \$5.55 for le \$ 1.20 x 6	$420.33$ = $97$ $4 \times 1.10 \text{ in}$ $5.683 \text{ (wst)}$ $3.36) + (1.2)$	$ \begin{array}{r} 41.67 \\ yv \\ 41.67 \\ yv \\ 41.67 \\ 41.6$	34 vendor 3.30 in cand. 1.661-=	- literati bulb + 20c
Madil cost = \$42.  tabor cost = \$1,20  Project cost = [	90 for fixture \$5.55 for le \$ 1.20 x 6	$420.33$ = $97$ $4 \times 1.10 \text{ in}$ $5.683 \text{ (wst)}$ $3.36) + (1.2)$	$ \begin{array}{r} 41.67 \\ yv \\ 41.67 \\ yv \\ 41.67 \\ 41.6$	34 vendor 3.30 in cand. 1.661-=	- literati bulb + 20c
Mat'l 40st = \$42. + Labor cost = \$1.20	90 for fixture \$5.55 for le \$ 1.20 x 6	$420.33$ = $97$ $4 \times 1.10 \text{ in}$ $5.683 \text{ (wst)}$ $3.36) + (1.2)$	$ \begin{array}{r} 41.67 \\ yv \\ 41.67 \\ yv \\ 41.67 \\ 41.6$	34 vendor 3.30 in cand. 1.661-=	- literati bulb + 20c
Madl cost = \$42.  +  Labor cost = \$1,20  Project cost = [	90 for fixture \$5.55 for le \$ 1.20 x 6	$420.33$ = $97$ $4 \times 1.10 \text{ in}$ $5.683 \text{ (wst)}$ $3.36) + (1.2)$	$ \begin{array}{r} 41.67 \\ yv \\ 41.67 \\ yv \\ 41.67 \\ 41.6$	34 vendor 3.30 in cand. 1.661-=	- literati bulb + 20c

#### Radford Army Ammunition Plant List of Buildings with Incandescent Lighting

Bldg No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
1000 -00	Cotton Linter Warehouse	NC. A&B-Line	1	17	17
1606 -00	Open Tank Air Dry	Sol. Recovery, A-Line	10	20	200
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	27	12	324
3513 -00	C-1 Press & Cutting House SG Curing Hse Carpet Rolls	Green, C-Line	3	· 20	60
4912 -27	SG Curing Hse Carpet Rolls	Cast Prop. (Rocket)	10	5	50
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	1	6	6
7106 -04	Dry House #4 (Cure Grain)	1st R P	7	8	56
9334 -15	Blender House	4th Rolled Powder	1	4	4
TOTAL FOR	EXTERIOR FIXTURES				717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
	Boiling Tub House		3	50	150
2022 -00	Beater House	NC, B-Line	3	40	120
2024 -00	Poacher & Blending House	NC, B-Line	3	30	90
3513 -00	C-1 Press & Cutting House	Green, C-Line	3	50	150
4912 -40	Forced Air Dry House	Pilot B	21	10	210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	1	4	4
	Small Grain Mold Assembly		1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
	TOW Launch Saw House		1	8	8
	15 Inch Press House		3	2	6
6304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	60 <u>0</u>
TOTAL FOR	INTERIOR FIXTURES				1536

CONSTRUCTION COST	ESTIMAT	ΓE		DATE PREPARED	)	SHEET	4 or 11
ENERGY ENGINEERING		R ESTIMATE					
RADFORD ARMY AMMUN		CODE A (No deergn	1				
ARCHITECT ENGINEER	CODE C (Final design)						
REYNOLDS, SMITH AND		CHECKED BY					
GP-N-2		ESTIM	7.	Tood			
Incaud. to fluor. SUMMARY	QUANT	TY	PER	LABOR	MATERIAL		TOTAL
	UNITS	MEAS.	UNIT	TOTAL	UNIT	TOTAL	COST
Replace incondescent	154	fixt.	0.98	151	53.30	8208	8359
lamps with 32 W fluor.							
circline screw-ins							-
	01					2/0	7/0
Sales tax	4.5%			7 0		369	369
FICA Insurance	20.0%	,		30		8577	30
Subtotal	10 -1			181		057 <i>T</i>	8758 1314
Over head	15.0%						1007
Profit Performance Bond	10.0%						111
	6.0%						671
Contingency	10.0%						1186
Construction Cost	10.06						13047
LONSINDELIDIK WIL							
							·
				4			
				•			
		·					
·							

ECP ENERGY CONSERVATION PRODUCTS, 511 CANAL STREET, NYC, NY, 10013—TEL (212)—925—5991

#### POWER CONSUMPTION AND LUMEN CUTPUT DATA

		TOTAL	LUMENS	HOURS OF	*
* WATTS	LINE WATTS	LUMEN CUTPUT	PER WATT	RATED LIFE	*
- MAIIS					
****** MERCUR	Y VAPOR (DELUX	E WHITE)			×
* 1000	1075	63000	. 59	24000	*
* 400	450	23000	56	24000	<del>X</del>
<b>*</b> 250	290	13000	42	24000	
* 175	205	8500	49	24000	*
* 100	120	4500	42	24000	<del>-</del>
* 75	93	3150	37	16000 16000	*
* 50	61	1680	31	10000	
****** METTAL	HALIDE				*
* 1500	1600	155000	103	3000	*
* 1000	1100	110000	100	12000	*
* 400	460	34000	85	15000	*
* 175	210	14000	85	7500	*
				=======================================	*
	PRESSURE SODIUM 1080	140000	130	24000	*
* 1000 * 400	480	50000	104	24000	*
* 250	310	27500	89	24000	- *
* 150	200	16000	80	24000	*
* 100	135	9500	70	24000	*
70	85	5800	68	24000	*
50	70	4000	57	24000	*
* 35	42	2850	67	18000	
************				=======================================	. *
*******FWORES	SCENT				*
STRAIGHT 40	48	3150	66	20000+	*
CIRCLINE 32	3	1830	50	12000+	<b>*</b>
CIRCLINE 22	25	1050	42	12000+	
CIRCLINE 20	23	850	37	12000+ 10000+	*
TWIN TUBE 13	16	900 600	56 50	10000+	*
TWIN TUBE 9 STRAIGHT 8	12	400	36	7500+	*
STRAIGHT 8 TWIN TUBE 7	10	400	40	10000+	*
STRAIGHT 6	9	300	33	7500+	*
TWIN TUBE 5		250	31 =	10000+	* ***
					*******
	DESCENT			1000	
1000	1000	23740	24	1000	
* 750	750 500	17040	23	1000	*
* 500	500	10850	22	1000 750	-
* 200 * 150	200 150	3710 (2880)	19 19	750	*
100	100	(1750)	18	750	*
* 75	75	1190	16	750	#-
	S—IODINF.	25000			<del>*</del>
* 1500 1000	1530	35800	24	3000 2000	*
* 1000 * 500	10 <b>00</b> 50 <b>0</b>	23 <b>400</b> 1095 <b>0</b>	23 22	2600	*
250	250	4850	19	2000	<del></del>
	2JV	VCUF			

	Lighting		DAILY	MAN-			BARE	COSTS		TOTAL
16	6 100   Lighting	CREW	ОИТРИТ	HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL O&P
1600	90 watt	1 Ele	.30	26.670	Ç	5,140	645		5,785	6,600
1650	135 watt		.20	40		6,905	970		7,875	9,025
700	180 watt	.	.20	40		7,308	970		8,278	9,475
1750	Quartz line, clear, 500 watt		1.10	7.270		1,872	175		2,047	2,325
1760	1500 watt		.20	40		3,427	970		4,397	5,200
1800	Incandescent, interior, A21, 100 watt		1.60	5		173	120		293	370
1900	A21, 150 watt		1.60	5		211	120		331	410
2000	A23, 200 watt		1.60	5		227	120 .		347	430
2200	PS 30, 300 watt		1.60	5		330	120		450	540
2210	PS 35, 500 watt		1.60	5		576	120		696	810
2230	PS 52, 1000 watt		1.30	6.150		1,525	150		1,675	1,900
2240	PS 52, 1500 watt		1.30	6.150		2,382	150		2,532	2,850
2300	R30, 75 watt		1.30	6.150		375	150		525	630
2400	R40, 150 watt	1	1.30	6.150		408	150		558	670
2500	Exterior, PAR 38, 75 watt		1.30	6.150		566	150		716	840
2600	PAR 38, 150 watt		1.30	6.150		525	150		675	795
2700	PAR 46, 200 watt		1.10	7.270		1,928	175		2,103	2,375
2800	PAR 56, 300 watt		1.10	7.270		2,193	175		2,368	2,675
3000	Guards, fluorescent lamp, 4' long		1	8		375	195		570	695
3200	8' long	1	.90	8.890		535	215		750	905
	RESIDENTIAL FIXTURES									
0400	Fluorescent, interior, surface, circline, 32 watt & 40 watt	1 Ele	c 20	.400	Ea.	48	9.70		57.70	67
2500	2' x 2', two U 40 watt		8	1		66	24		90	110
700	Shallow under cabinet, two 20 watt		16	.500		45	12.15		57.15	67
0900	Wall mounted, 41, one 40 watt, with baffle		10	.800		41	19.40		60.40	74
000	Incandescent, exterior lantern, wall mounted, 60 watt		16	.500		36	12.15		48.15	57
2100	Post light, 150W, with 7' post		4	2		104	49		153	185
2500	Lamp holder, weatherproof with 150W PAR	1 1	16	.500		16	12.15	i	28.15	35
2550	With reflector and guard		12	.667		31	16.15		47.15	58
2600	Interior pendent, globe with shade, 150 watt	1 1	20	.400		78	9.70		87.70	100
0010	TRACK LIGHTING									
0080	To the desiration of T	1 Ek	6.70	1.190	Ea.	33	29		62	79
0100	8' section		5.30	1.510		48	37		85	105
0200	Track, 1 circuit, 4' section  8' section  12' section		4.40	1.820		81	44		125	155
0300	3 circuits, 4' section		6.70	1.190		36	29		65	82
0400	8' section		5.30	1.510		48	37		85	105
0500	8' section 12' section Feed kit, surface mounting		4.40	1.820		88	44		132	160
1000	Feed kit, surface mounting		16	.500		12	12.15		24.15	31
1100	End cover		24	.333		1.98	8.10		10.08	14.0
1200	Feed kit, stem mounting, 1 circuit		16	.500		16	12.15		28.15	35
	3 circuit		16	.500		16	12.15		28.15	35
1300 2000	Electrical joiner for continuous runs, 1 circuit		32	.250		6.55		1	12.60	16.1
			32	.250		12.10	-		18.15	22
2100	3 circuit		16	.500		47	12.15	1	59.15	
2200	Fixtures, spotlight, 150 PAR		16	.500		101	12.15	_	113.15	_
3000	Wall washer, 250 watt tungsten halogen		16	.500		102	12.15	1	114.15	
3100	Low voltage, 21/2 watt, 1 circuit	1	10	.500	-	102	12.15		121.15	

GF-N-2 p. 70+11

66	Lighting	11.				. 7 1	े कि असू			ï
			DAILY	MAN-			BARE		TOTAL	
16	66 100 Lighting	CREV	OUTPUT	HOURS	UNIT	MAT.	LABOR	EQUIP. TOTAL	INCL OAP	L
5100	175 watt metaj halide	1 Ele	с 8	1	Ea.	479	24	503	565	1
5110	250 watt metal halide		8	1		500	24	524	585	1
5120	150 watt high pressure sodium		8	1		535	24	559	625	ı
5130	250 watt high pressure sodium		8	1		556	24	580	645	1
-	72"H 18" sq., 400 watt metal halide		8	1		525	24	549	615	1
5140	250 watt high pressure sodium		8	1		556	24	580	645	1
5150		1	8	1		581	24	605	675	1
5160	400 watt high pressure sodium	1 '		<u> </u>	'					ı
5190	Portable rectangle, 6" high 13.5" x 20"	1 Ele	c 12	.667	Ea.	293	16.15	309.15	345	1
5200	175 watt metal halide	1 5	12	.667	i i	314	16.15	330.15	370	ı
5210	250 watt metal halide	+	_	.667		335	16.15	351.15		1
5220	150 watt high pressure sodium	1	12			360	16.15	376.15		ı
5230	250 watt high pressure sodium		12	.667			16.15	381.15		1
5240	8" high 18" x 24", 400 watt metal halide		12	.667		365		392.15		l
5250	250 watt high pressure sodium		12	.667	$\vdash$	376	16.15			1
5260	400 watt high pressure sodium		12	.667		398	16.15	414.15		1
5270	Portable square, 15" high 13.5" sq., 175 watt metal halide	4	12	.667		324	16.15	340.15		ł
5280	250 watt metal halide		12	.667		376	16.15	392.15	i i	
5290	150 watt high pressure sodium		12	.667	<b>-</b>	360	16.15	376.15		4
5300	250 watt high pressure sodium		12	.667		386	16.15	402.15	1	
5400	Pendent 16" round/square, 175 watt metal halide		3.20	2.500		355	61	416	480	4
5410	250 watt metal halide		2.70	2.960		370	72	442	515	1
5420	400 watt metal halide		2.40	3.330		398	81	479	555	4
5430	150 watt high pressure sodium		3.20	2.500		398	61	459	525	ı
5440	250 watt high pressure sodium		2.70	2.960		428	72	500	575	_
5450	400 watt high pressure sodium		2.40	3.330		454	81	535	620	ı
	Too waterings processes seems.	1 '								
0010	LAMP8									
	Fluorescent, rapid start, cool white, 2' long, 20 watt	1 8	ec 1	8	С	348	195	543	670	
0080	4' long, 40 watt		.90	8.890		198	215	413	535	
0100			.90	8.890		442	215	657	805	1
0120	3' long, 30 watt		.80	10		874	(245)	1,119	1,325	
0150	U-40 watt		.90	8.890		270	215	485	615	
0170	4' long, 35 watt energy saver	-1	.90	8.890		618	215	833	995	
0200	Slimline, 4' long, 40 watt	1 1	.80	10		577	245	822	990	
0300	8' long, 75 watt	-1-	.80	10		603	245	848	1,025	_
0350	8' long, 60 watt energy saver	1		8.890		750	215	965	1,150	
0400	High output, 4' long, 60 watt	-	.90		$\vdash$	775	245	1,020	1,200	_
0500	8' long, 110 watt	11	.80	10		1	215	1,500	1,725	
0520	Very high output, 4' long, 110 watt		.90	8.890	_	1,285		1,560	1,825	-
0550	8' long, 215 watt		.70	11.430	1	1,285	275	2,787	3,300	
0600	Mercury vapor, mogul base, deluxe white, 100 watt	$\rightarrow$	.30	26.670	_	2.142	645			_
0650	175 watt		.30	26.670		1,663	645	2,308	2,775	
0700	250 watt		.30	26.670	_	2,968	645	3,613	4,225	_
0800	400 watt	1 1	.30	26.670		2,340	645	2,985	3,525	
0900	1000 watt		.20	_	$\bot$	5,100	970	6,070	7,025	_
1000	Metal halide, mogul base, 175 watt		.30	1		3,749	645	4,394	5,075	
1100	250 watt		.30	26.670	1	4,712	645	5,357	6,125	_
1200	400 watt		.30	26.670		4,386	645	5,031	5,775	
1300	1000 watt		.20	40		9,894	970	10,864	12,300	
1320	1000 watt, 125,000 initial lumens		.20	40		9,960	970	10,930	12,400	
1330	1500 watt		.20	40		9,268	970	10,238	11,600	
	Sodium high pressure, 70 watt		.30	_		4,712	645	5,357	6,125	
1350			.30		1 1	4.871	645	5.516	6,300	
860	100 watt		.30		_	5,059	645	5,704	6,525	
1370	150 watt		.30	1	1	5,380	645	6,025	6,875	
1380	250 watt	-	.30		_	5,727	645	6,372	7,250	
1400	400 watt					13,352	970	14,322	16,100	
1450	1000 watt		.20	_	1	3,963	645	4,608	5,300	
1500	Low pressure, 35 watt		.30	1	1 1		645	5,031	5,775	
1550	55 watt		.30	26.670	1 1	4,386	040	3,001	19	_

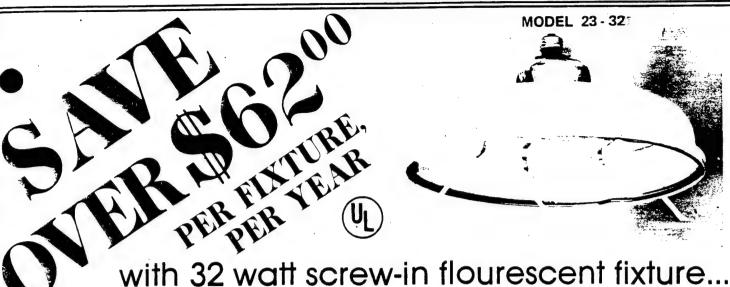
GP-N-3

ECP ENERGY CONSERVATION PRODUCTS 511 CANAL STREET NEW YORK, N.Y. 10013 (212)925-5991

EFFECTIVE 3/1/84

LAMP PRICE	ES.
------------	-----

ORDERING CODE	TABE	WATTAGE	LIST	CONT.	MIN QTY
F4T5/CW F4T5/WW	FLUORESCENT FLUORESCENT	14 14	6.37 7.17	3.19 3.59	12 12
F6T5/CW F6T5/WW	FLUORESCENT FLUORESCENT	6 6	6.37 8.79	3.20 4.40	12 12
F8T5/CW F8T5/WW	FLUORESCENT FLUORESCENT	8 8	6.03 7.15	3.02 3.58	12 12
FC6T9/CW FC6T9/WW	FLUORESCENT FLUORESCENT	20 20	10.00 11.35	5.00 5.68	12 12
FC8T9/CW FC8T9/WW	FLUORESCENT FLUORESCENT	22 22	10.00	5.00 5.68	12 12
FC12T9/CW FC12T9/WW	FLUORESCENT FLUORESCENT	32 32	11.10 12.50	5.55	12 12
FC16T9/CW FC16T9/WW	FLUORESCENT FLUORESCENT	40 40	13.00 14.75	6.50 7.38	12 12
PL-7 PL-9 PL-13	FLUORESCENT FLUORESCENT FLUORESCENT	7 9 13	13.00 13.00 14.00	6.50 6.50 7.00	10 10 10
LU-35 LU-50 LU-70 LU-100 LU-150	H.P.S. H.P.S. H.P.S. H.P.S.	35 50 70 100 150	70.00 70.00 70.00 80.00 80.00	35.00 35.00 35.00 40.00	66666
ESX (NARROW) BAB (WIDE)	QUARTZ HALOGEN QUARTZ HALOGEN	20 20	20.00 20.00	10.00	<u>4</u> 4
EXT (NARROW) EXN (WIDE)	QUARTZ HALOGEN QUARTZ HALOGEN	50 50	21.00	10.50 10.50	14 14
EYF (NARROW) EYC (WIDE)	QUARTZ HALOGEN QUARTZ HALOGEN	75 75	22.00 22.00	11.00	4 4
****	M M M M M M M M M M M M M M M M M M M				

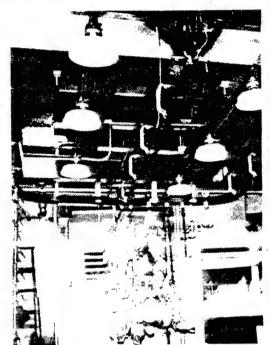


with 32 watt screw-in flourescent fixture... replaces 150 watt bulb

(available in 54 watts)

## **Advantages**

- 1. Immediate savings (no rewiring)
- 2. Long life (12,000 hrs)
- 3. Unbreakable (poly carbonate) lens
- 4. Reduced heat load (saves on refrigeration costs)
- 5. Easy cleaning
- 6. Equal illumination



Before

## **COMPARE COSTS\***

After

150 watt RS/TF inca 32 watt floures	savings				
Energy Cost	\$46.80	VS	\$11.54	(Including Ballast)	\$32.56
	\$21.31	VS	\$ 1.82	la	\$19.49
By reducing the heat load cau you can achieve additional sc	\$10.85				
in 19gged on 12 hour burn (3 d <b>a</b> vs ber	veek		Total Sc	avings	\$62.90

DISTRIBUTED BY:



## TWIST OF THE WRIST® BRAND ENERGY SAVING LIGHTING FIXTURES

## MODEL 23 32 WATT OR 54 WATT

SOCKET: Standard Medium Base HOUSING:

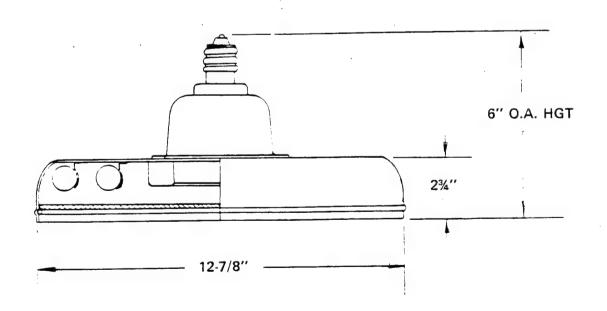
Aluminum

**DIFFUSER:** Clear Polycarbonate

BALLAST: Robertson R32AP-WS (32 watt)

Robertson R2232P-WS (54 watt)

MODEL =	LAMP	WATTAGE	TEMPERATURE RANGE
23-32 23-54	FC12T10 FC12T10 FC8T9	32 32 22	Down to 32 F Down to 32 F
23-32-0′ 23-54-0′	FC12T10 FC12T10	32 32	Down to 0 ° F Down to 0 ° F





GRNZ piliofil

ECP ENERGY CONSERVATION PRODUCTS
511 CANAL STREET NEW YORK, N.Y. 10013 (212)925-5991

EFFECTIVE 3/1/84

PRICING -	MODEL #	23	SCREW_IN	FILIORESCENT	CONVERSIONS
I TITOTIO -		ر <i></i>	DOMENTA	LHOOMEDCENT	CONTENDIONS

FIXTURE PRICES	DO NOT INCLUDE LAMPS.			
MODEL	DESCRIPTION	LIST	CONT.	MIN QTY
23 <b>-</b> 32 =====	32 WATT SCREW IN FLUORESCENT FIXTURE (WHITE FINISH) WITH LEXAN DIFFUSER.	85 <b>.</b> 80	42.90	3
23-54	54 WATT SCREW IN FLUORESCENT FIXTURE (WHITE FINISH) WITH LEXAN DIFFUSER. OPTIONS	99.30	49.65.	3
DIFFUSER	N - WITHOUT LEXAN DIFFUSER DEDUCT	9.90	4.95	-
BALLAST	V - 277 VOLT BALLAST	12.00	6.00	
	O - ZERO DEGREE HALLAST (DOWN TO O F) 32WATT 54WATT	16.00 16.00	8.00 8.00	-

## STANDARD MODEL BALLAST WILL LIGHT DOWN TO 32 F. ORDERS BELOW MINIMUM ADD 10%

	PRICING - MODEL #25 RECESSED CEILING	FIXTURE	RETRO-FIT	
FIXTURE PRICES D	O NOT INCLUDE LAMP.			
MODEL	DESCRIPTION	LIST	CONT.	MIN QTY
25-20-DW ======	20 WATT RECESSED FLUORESCENT CONVERSION FIXTURE WITH SCREW IN ADAPTOR AND WHITE ACRYLIC			
	DIFFUSER (WHITE FINISH)	91.80	45.90	5
25-22-DW	22 WATT - SAME AS ABOVE	104.00	52.00	100
	OPTIONS			
DIFFUSER	PQ - PARASQUARE PA - PARAHEX	-	6.70 7.45	-
BODY TYPE	A - ADJUSTABLE STEM	(	CONSULT FAC	CTORY
BALLAST	C - COLD WEATHER BALLAST	14.00	7.00	-

ORDERS BELOW MINIMUM ADD 10%

and the second s	RAAP Lighting	Projects ASP NO. 29	00 0379 000
YNOLDS, SMITH AND HILLS	BUBLICT RAAP Lighting	SHEET	1 of 10
HITECTS • ENGINEERS • PLANNERS	DESIGNER T. Todd		
INCORPORATED	CHECKER	DATE	
GP-N-3 REPLACE	EXTERIOR INCANDE	SCENTS WITH	COMPACT
PLUORESC	ENT FLOODS		
Many buildings at	RAAP are list wit	h inefficient is	cardescent
		00	
lighting. This ECO	onalyzes the replan	cement of exteri	or incord.
10	0 0		
floods with 13WPL	compact phones cent	flood retrofito	which
	UD	U U	
Acrew into the incan	descent pockets. The	o type of pro	ject is
	1		
suitable for mon-en	blosion proof fixtu	red in areas u	vkere
D = 0	1 1 0 0	0.100	
a 20-30% reduction	on in light level is	acceptable. a	ato and
savings were calculate	ed on a per unit	bases as show	n on page 2.
Only Oareas operating =	Shift day, 5 days /1	the were council	reac.
Javings were calculated only areas operating =	rth uncondescent lig	herry was comp	wed from
0 0			Dat 1-4 57
the building survey	dota (page 3).	t wassumed th	20 Co
			tool lands
of the exterior fextu	res on this list are	non-expection	TX Town
0	== 0 5 / 717 \ - 3	259	
Number of texture	5 = 0.5 (717) = 3	359 11	774 MRHU
Energy savings = 1	336 kml , 0.003413 L	1074 × 30 = 10	45
	- Jr	wh	
	\$25,30 , 359 field	4 4 4 4 4 4 4 4	Jac
Energy cost surings=	40 Gill 1	<del>165 = 1000</del>	(d)
4	11063	× 359 = + 668	alm
Mall & Labor cost	savings + \$ 18.63	¥ 200 = 1880	10
Total cost surings	= 9083 + 6688=	\$ 15,771/4V	
Project cost = \$66	.73 fridure x 359	\$23,956	
	ost = 23, 956 / 1.45	. And the company of	
Style Parabach	+E3 556 //378 771/w	= 1.5 UV	

	Screening	Lighting Pr	ojeds AEPN	. 290 C	6379 00 of 10
NOLDS, SMITH AND HILLS	SCREENING T.	Todd	SHEET		OF
INCORPORATED	CHECKER		DATE		
	4 1 1 1 1 1	- 0 1 2 2		010-01	
IP-N-3 Reduce light leve	15 - limit	ed applica	strans to b	place	exactor
150 W Chandesc	ents with 13	3 W FY &	luorescent s	Excu-in	18trafits
	1. 0 0 10		2 74 %		
- Assume original ligh	I levels can be	Juduces by	y 10-30%		
0 0		11/1-			
- Assume non-explos	ion proof a	plication			
4	000	V			
		241	2/2 4	97.1	
Energy savings = (1	50 W - 10 W		160 days -	836	Burk
0 0		dey	gr		2
	976 10	40.202	6 - \$ 25	70	
Energy cost savings	= 000 Kura	X 70,000	6 = 123	w .	-
U U		kurh		<del>}</del>	
	/-		er, cost \x	8740 4	100
Labor 4 mot l cost savis	150 h		000 W	d	
- [ (\$ 2,11 mode + \$1.20	U		til + \$1.95 lab	0 × 0. 18	3) 7. 6240
	) Mauer ~ 416000		10,000 hr		7 1
150 hr	\$ 18.63				7   6
Total cost savings =	= \$25.30	\$ 18.63	443.93		-
10141 (0)	yv	yv	yv		
		0	0		1
Mot'l cost = \$37	32 for fixtur	e price inclu	ding lamp (	1989 va	whom who ,
			7	Reflect-A-	Ster Hood
Labor cost = \$1.20	0 × 1, 2 × 0, 68	33 (10st of	replaning in	cand. +	20%)
7, 7, 7			0 1		
Project cost=	(1.045 x \$ 37.3	32)+(1.2x	\$ 0.98) x	1.66 =	\$66. F3
				· · · · · · · · · · · · · · · · · · ·	
Simple paypack = +	66.73 =	1.5 yr	< 10 yr	=> recom	mended
\$4	3.93/w		O		
	.0				
					**   **   **
		+ + + + + + + + + + + + + + + + + + + +			-     -

R	Sel	H
		(R)

SUBJECT	AEP NO
	SHEETOF
DESIGNERPFH	DATE 10/29/90
CHECKER	DATE

## QRIP Cale's

Current energy costs:

150W x 2 the x 260 de = 1000 x 35 laups x \$0.3026/kwh=

= \$10,168/gr.

Current material & labor costs:

cost/lamp \* 359 \* 6240hrs

2.11 + 1.2 × 0.68 × 359 × 6240 = \$8750/yr

New energy conts:

16 x 24 x 260 = 1000 x 359 x 0,03826 = \$1085/gr.

New matil & labor conts

7.88 +1.95 x 0.68 x 359 x 6240 = \$ 2062/y-

Labor savings

(1.2 × 0.68 = 1.95 × 0.68) × 359 × 6240 = \$ 2140/yr

For fluorescents, replace to lamp only.

#### Radford Army Ammunition Plant List of Buildings with Incandescent Lighting

Bldg No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
1000 -00	Cotton Linter Warehouse	NC, A&B-Line		17	17
1404 -00	Open Tank Air Dry	Sol. Recovery, A-Line	10	20	200
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	21	12	324
3513 -00	C-1 Press & Cutting House	Green, C-Line	. এ	20	60
4912 -27	SG Curing Hse Carpet Rolls	Cast Prop. (Rocket)	10	5	50
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	1	6	6
7106 -04	Dry House #4 (Cure Grain)	1st R P	7	8	56
9334 -15	Blender House	4th Rolled Powder	1	4	4
TOTAL FOR	EXTERIOR FIXTURES				717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
2019 -00	Boiling Tub House	NC. B-Line	3	50	150
2022 -00	Beater House	NC. 8-Line	3	40	120
2024 -00	Poacher & Blending House	NC, B-Line	3 3 3	30	90
	C-1 Press & Cutting House			50	
4912 -40	Forced Air Dry House	Pilot B	21	10	. 210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)	1	4	4
4915 -00	Small Grain Mold Assembly	Cast Prop. (Rocket)	1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
4951 -02	TOW Launch Saw House	Pilot B	1	8	8
5008 -01	15 Inch Press House	Pilot A	3	2	6
6304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	600
TOTAL FOR	INTERIOR FIXTURES				1536

RSI	I
	- ®

SUBJECT		AEP NO		
		SHEET	OF	
DESIGNER	4	DATE		
CHECKER		DATE		

Current mal'l coste:

New mal'l costs

Carrent labor !

New labor:

CONSTRUCTION COST	DATE PREPARED	)	SHEET	4 or 10			
OJECT ENERGY ENGINEERING	ANALYS	IS			*	R ESTIMATE	
RADFORD ARMY AMMUN		CODE A (No deel	desi <b>gn)</b>				
ARCHITECT ENGINEER	CODE C (Final decign)						
REYNOLDS, SMITH AND		CHECKED BY					
GP-N-3	QUANT			T. Todd		AATERIAL	
Turand to fluor, flood Summary	NO.	UNIT MEAS.	PER	TOTAL	PER	TOTAL	TOTAL COST
Replace in cardescent	359	fivt.	0.98	352	37.32	13398	13750
floods with 13W PL							
fluorescent floods							
Color Tol	4.5%					603	603
Sales Tax	10.0%			70		002	70
FICA/INSTANCE Subtotal	20.01		·	422		14.001	14423
Overhead	15.0%			120	•		2163
Profit	10.07						1659
Performance Bond	1.07						182
Hercules Support	6.0%						1106
Contingency	10.0%						1953
Construction Cost							21486
		· .					
						`	

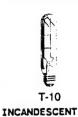
#### GP-N-3 P. 5 of 10

#### **INCANDESCENT LAMPS**

#### GENERAL ELECTRIC LAMPS











1000 1000 2500

1000

1280

317/18 317/18 317/18

317/15

I.F.--Ext. Serv.

960 I.F.--Rough Serv.



	A-21	G-16	6½ H-40						4-40		
Bulb	Base	Prod. Code	Lamp Ordering Code	Volts	Pkg.	Fila- ment Desgn	MOL (In.)	LCL (In.)	Rated Avg. Life Hours	App. Init Lum.	DESCRIPTION See Incandescent footnotes pg. 46
100 W	ATTS (Cont	inued) 39627	100G40/W	120	24	cc-e	6:3/16		2500	1280	Pearl (White)
G-40	Medium	49781	100G40/W	6PK 120	6	cc-e	615/15		2500	1280	Globe Pearl (White) Globe. Moonglow
G-40	Medium	13046	100G40/W/L	120	24	cc-e	617/16		4000	1220	Pearl (White) Globe
A-23 A-23 A-23	Medium Medium Medium	18610 18594	100A/B 100A/G 100A/D	120 120 120	120 120 120 120	CC-6	519/18 519/18 519/18 519/18		750 750 750 750		*Blue *Green *Orange *Red
A-23 A-21	Medium Med.(BB)		100A/R 100A21/TS	120 120	120		4 3/1	2 1/16	3000	1280	ClearTraffic Signal. Rated Watts: 98. BDTH (78)
A-21 A-21 A-21	Med.(BB) Med.(BB) Med.(BB)	18386	100A21/TS 100A21/SP 100A21/4SP	130 120 120	120 120 120	C-5	4 <sup>3</sup> / <sub>8</sub> 4 <sup>3</sup> / <sub>8</sub> 4 <sup>3</sup> / <sub>8</sub>	2 <sup>1</sup> / <sub>15</sub> 3 3	3000 200 200	1280 1340 	ClearSpotlight Light I.FMed- ical Spotlight
A-23 A-23	Medium Med.(88)		100A23 100A23/20	120 120	120 120		513/16 513/16	4 1/18 4 1/18	750 1000	==	Inside Frost ClearCommer- cial Oven
G-16%	S.C.Bay.	18717	100G16½/29SC	120	60	CC-1	3 3	. 13/8	200	1660	ClearSpotlight. BDTH (7,86,99)
G-16½ G-16½ R-40	D.C.Bay. D.C.Bay. Medium	18723	100G16½/29DC 100G16½/29DC ==100R/FL	120 130 120	60 60 24	CC-1 CC-1 CC-6	3 3	13/1	200 200 2000	1660 1660 1190	# # #
R-R-	Medium Medium		** 100R/FL 100R/SP	130 120	24 24	CC-6			2000 2000	1190 1190	Refl. Spot-Light I.F. (4,35,56)
T-8½	Medium	18898	100T8½/9	120	24	CC-1	3 5 1/1	3	50	1920	MicroscopeANSI: EDR (22,86,99)
T-10 (HRG)	D.C.Med. Ring	18905	100T 10/7	6	24	C-6	51/2	2 3/15	50		itContour Pro- jector ANSI: CPS (1,86.99)
T-10 (HRG)	Med.Pref	18907	100T 10P	6	24	C-6	5 3/4	2 1/15	50		ffContour Pro- jector ANSI: CPT (1.86.99)
A-23 PAR-38		18512 18822	100A23 100PAR38/FL	12 12	120 12	C-6	51% 4 % 4 %	4 1/:6	1000 1000	1400	Inside Frost (53) PARMine Flood (58)
	Prong Med.Skir (BB)	18824	100PAR38/2FL	12	12	C-6	5 1/15		1000	1400	PARFlood (14,56.96)
(HRG) PAR-64 (HRG)	Scr.Term	>39394	100PAR64	6	12	C-6	4		50		CeilometerVery Narrow Spot. Filament shielded
R-30 (HRG)	Med.(88)	>39503	100R30/CL	12	. 24	C-6	5 3/8		2000	1200	Reflector Flood Clear (4,14,53)
T-8	S.C.Bay.	18881	100T8/1SC	20	24	cc-e	3	2 3/15	50		Clear-Contour Map ANSI: BZA (8,31,61,86,94)@
A-21 A-21	Medium Med.(BB)		100A/RS 100A21/3	30 32	120 120	C-5	51/4	313/16	1000	1610	I.FRough Serv. ClearLocomotive Headlight (13)
A-23 A-23 PAR-46 (HRG)	Medium Med.(BB) Scr.Term (BB)	>17906	100A 100A/BB 100PAR46	34 34 60	120 120 12	C-9 CC-2		4 1/15	1000 1000 800	2160	I.FTrain  * Mine Locomotive Headlight (71)
A-21	Medium	17976	100A	230	120	C-7A	51/4	313/18	1000	1280	Inside Frost

Medium

Medium

Med. (BB)

17976 100A 17983 100A 18346 100A/99

18334 100A/RS

120 120 120

120

C-17

A-21

A-21

New product listing.
In "base up" use, heat eventually may deteriorate paper-lined or plastic sockets.
Source W x H: 4.5 x 3.0mm. Burn base up.
If Filament offset .100" +-.030" from base axis.
FOR ENERGY SAVING in deep down lights consider the 75ER30 lamp shown on page 23 . The resulting less savings are shown on page 5.

#### GENERAL ELECTRIC LAMPS

#### **INCANDESCENT LAMPS**





INCANDESCENT

R-40

						Fila-			Rated Avg.	App.	DESCRIPTION
Bulb	Base	Prod. Code	Lamp Ordering Code	Volts		ment Desgn	MOL (In.)	(In.)	Life Hours	Init Lum.	See Incandescent footnotes pg. 46
	Med.Side	tinued) 41966	150PAR46/3NSP	125	12	CC-1	3 4	• • •	2000	1500	Narrow Spot
	Prong Med.Side	41968	150PAR46/3MFL	125	12	CC-1	3 4		2000	1500	(11,56,58,96) Medium Flood (11,56,58,96)
	Prong Scr.Term	19517	150PAR46	125	12	C-13	3 1/4		1000		Mine Locomotive
(HRG) PAR-46 (HRG)	(BB) 3-Prong	>35327	150PAR46/TS	115	12	cc-e	4		6000		Headlight Traffic Signal Stippled
nku)		-						. *			Reflector Tapioca lens cover (2)
	Med.Side	44933	150PAR/3VWFL	125	12	C-13	4 %		2000		f MineWide Flood (56,58,96)
HRG) AR-38 HRG)	Prong Med.Side Prong	19497	150PAR/4	125	12	C-13	4 1/18		2000		1 MineSpot (56,58,96)
	Med.Skir (BB)	19509	150PAR/5	125	12	C-13	5 1/18		2000		1 MineSpot (14,56,96)
AR-46 HRG)	Scr.Term (BB)	19518	150PAR46/3	175	12	C-13	33/4		800		Mine. Locomotive Headlight (71)
1-40	Medium	19797	**150R/FL	120	24	¢¢-6	6 1/15		2000	1900	Reflector Flood ANSI: DWC
2-40	Medium	>16445	150R/FL-1	120	30	CC-6	6 1/16		2000	1900	(4,14,35,56) Standard Re- flector Flood
-40	Medium	19799	**150R/FL	130	24	CC-6	6 %		2000	1900	(4,14,35,56) Reflector flood
-40	Med.(88)	14715	15OR/FL/CVG	130	24	CC-6	6 %		2000		(4,14,35,56) >>Refl. Flood COV-R-GUARD™
-40	Medium	19783	15OR/SP	120	24	cc-e	6 1/18		2000	1900	(4,35,56,83) Refl. SpotLight I.F. (4,14,35,56)
-40	Medium	>16446	150R/SP-1 6PK	120	30	cc-e	6 1/18		2000	1900	Standard Reflecto Spot (4,14,35,56)
-40	Medium	19785	15OR/SP	130	24	cc-e	6 %		2000	1900	Reflector Spot Light I.F.
-40	Medium	19844	150R/A	120	24	CC-6	6 %		2000		(4,14,35,56) ReflectorAmber
-40	Medium	19823	150R/B	120	24	CC-6	6 %		2000	,	(14,35,36) ReflectorBlue
-40	Medium	19827	15OR/BW	120	24	CC-6	6 1/16		2000		(14,35,36) ReflectorSlue-
-40	Medium	19831	150R/G	120	24	cc-e	6 %		2000		White (14,35,36) ReflectorGreen
-40	Medium	19835	150R/PK	120	24	cc-e	6 %		2000		(14,35,36) ReflectorPink
-40	Medium	19841	150R/R	120	24	cc-e	6 %		2000		(14,35,36) ReflectorRed
-40	Medium	19851	150R/Y	120	24	CC-6	6 %		2000		(14,35,36) ReflectorYellow (14,35,36)
-40	Med.(BB)	41627	150R40/PL 100 700 6PK	120	24	cc-e	6 %		2000		Reflector Plant Light*Gro and
-40	Medium	44674	150R40/TB	120	24	cc-e	6 %5		2000		Sho* (4,14,56) Jewelry Spot Re- flector Transpar-
-40	Medium	44675	150R40/TB	130	24	cc-e	6 %s	••	2000		ent Daylight Blue (4,14,35,56,76) dewelry Spot Re-
						·		1 1		**	ent Daylight Blue (4,14,35,56,76)
-25	Med.(BB)	19372	150P25/10	120	60	C-5	4 1/4	3	200	2100	Light I.FSpot- light. Hard glass button

New product listing.
> Teflon® Coated. Teflon is a registered trademark of Dupont.

Operating position horizontal with locating lug up or down, and with lamp supported by bulb rim.

\* FOR ENERGY SAVING in deep down lights consider the 75ER30 lamp shown on page 23 . The resulting cost savings are shown on page 5.

	Lighting		DAIL	Y MA	N-			BARE	COSTS		TOTAL	1
16	66 100 Lighting	CRE	W OUTP	л ног	JR3	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL DEP	
600	90 watt	1 8	ec .30	26.	670	Ç	5,140	645		5,785	6,600	1
650	135 watt		.20	4	0		6,905	970		7,875	9,025	
700	180 watt	П	.20	4	0		7,308	970		8,278	9,475	
750	Quartz line, clear, 500 watt		1.10	7.2	70		1,872	175		2,047	2,325	
760	1500 wett		.20	4	0		3,427	970		4,397	5,200	
800	Incandescent, interior, A21, 100 watt		1.60		5		173	120		293	370	_
900	A21, 150 watt		1.60	5	5		211	(120)		331	410	
000	A23, 200 watt		1.60	) !	5 _		227	120		347	430	_
200	PS 30, 300 watt		1.60	) !	5		330	120		450	540	
210	PS 35, 500 watt		1.60	) !	5		576	120		696	810	_
230	PS 52, 1000 watt	П	1.3	6.1	50		1,525	150		1,675	1,900	
240	PS 52, 1500 watt		1.30	6.1	50		2,382	150		2,532	2,850	
300	R30, 75 watt		1.3	6.1	50		375	150		525	630	
400	R40, 150 watt		1.30	6.1	50		408	150		558	670	_
500	Exterior, PAR 38, 75 watt		1.3	6.1	50		566	150		716	840	
500	PAR 38, 150 watt		1.3	6.1	50		525	150		675	795	
700	PAR 46, 200 watt		1.10	7.2	270		1,928	175		2,103	2,375	
800	PAR 56, 300 watt		1.10	7.2	270		2,193	175		2,368	2,675	
000	Guards, fluorescent lamp, 4' long		1		3		375	195		570	695	
200	8' long		.90	8.8	390		535	215		750	905	_
010	RESIDENTIAL FIXTURES	Т										
400	Fluorescent, interior, surface, circline, 32 watt & 40 watt	1 E	lec 20	.4	00	Ea.	48	9.70		57.70	67	_
500	2' x 2', two U 40 watt		8		1		66	24		90	110	
700	Shallow under cabinet, two 20 watt		16	.5	00		45	12.15		57.15		_
900	Wall mounted, 41., one 40 watt, with baffle		10	.8	00		41	19.40		60.40	74	
000	incandescent, exterior lantem, wall mounted, 60 watt		16	.5	00		36	12.15		48.15		_
100	Post light, 150W, with 7' post		4		2		104	49		153	185	
500	Lamp holder, weatherproof with 150W PAR		16	.5	000		16	12.15		28.15		-
550	With reflector and guard		12	.6	67		31	16.15		47.15		
600	Interior pendent, globe with shade, 150 watt		20	.4	100		78	9.70		87.70	100	_
010	TRACK LIGHTING	Т										
080	Track, 1 circuit, 4' section	1 E	3ec 6.7	0 1.	190	Ea.	33	29		62	79	_
100	8' section 12' section		5.3	0   1.	510		48	37	İ	85	105	
200	12' saction 및 로 원 _		4.4	_	820	lacksquare	81	44		125	155	-
300	3 circuits, 4' section		6.7		190		36	29		65	82	
400	8' section 12' section Feed kit, surface mounting		5.3		510	$\vdash$	48	37		85	105	-
500	12' section		4.4		820		88	44		132	160	
000	Feed kit, surface mounting	$\perp$	10	_	500		12	12.15		24.15	-	-
100	End cover		24		333		1.98			10.08		
200	Feed kit, stem mounting, 1 circuit		10	_	500		16	12.15		28.15		-
300	3 circuit		10		500		16	12.15	1	28.15	1	
2000	Electrical joiner for continuous runs, 1 circuit		3:	_	250	$\sqcup$	6.55	_		12.60		11
2100	3 circuit		3		250		12.10	1		18.15		
200	Fixtures, spotlight, 150 PAR		10	_	500	$\sqcup$	47	12.15	-	59,15		-
2000	Wall washer, 250 watt tungsten halogen		10	1	500		101	12.15	1	113.15		
1100	Low voltage, 2% watt, 1 circuit		1	_	500		102	12.15		114.15		-
120	3 circuit		11	1	500	1	109	12.15	1	121.15	140	

	Lighting			DAILY	MAN-			BARE (	COSTS		TOTAL	Γ
-	6 100   Lighting	CRE	-w	OUTPUT	HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL OEP	ı
		-	-			Ea.	479	24	Laur.	503	565	t
5100	175 watt metal halide	1 E	HEC	8	1	<u> </u>	500	24	1	524	585	l
5110	250 watt metal halide	+	-	8	<del>-                                    </del>	-	535	24		559	625	۱
5120	150 watt high pressure sodium			8	_ !		556	24		580	646	I
5130	250 watt high pressure sodium	+	-	8		-	525	24		549	615	1
5140	72"H 18" sq., 400 watt metal halide			8	1		556	24		580	645	١
5150	250 watt high pressure sodium	-	$\dashv$	8	-!-	-	581	24		605	675	1
5160	400 watt high pressure sodium	١ '	'	8 .	1	1	351	-		•••	0,0	ı
5190	Portable rectangle, 6" high 13.5" x 20"	+-	-	-10	cor	50	293	16.15		309, 15	345	1
5200	175 watt metal halide	1 E	.BC	12	.667	Ea.	314	16.15		330.15	370	I
5210	250 watt metal halide			12	.667	$\vdash\vdash$	335	16.15		351,15	390	1
5220	150 watt high pressure sodium			12	.667			16.15		376.15	420	ı
5230	250 watt high pressure sodium	+		12	.667		360			381.15	425	1
5240	8" high 18" x 24", 400 watt metal halide			12	.667		365	16.15		392.15	435	ı
5250	250 watt high pressure sodium		$\dashv$	12	.667		376	16.15		414.15	460	1
5260	400 watt high pressure sodium			12	.667		398	1 1		340.15	380	ı
5270	Portable square, 15" high 13.5" sq., 175 watt metal halide	-	$\vdash$	12	.667		324	16.15	-	392.15	435	ł
5280	250 watt metal halide			12	.667		376	16.15		376.15	420	
5290	150 watt high pressure sodium		Н	12	.667	-	360 386	16.15		402.15	450	1
5300	250 watt high pressure sodium			12	.667		355	61		416	480	١
5400	Pendent 16" round/square, 175 watt metal halide	1	Н	3.20	2.500	$\vdash$	370	72		442	515	٦
5410	250 watt metal halide			2.70	2.960		398	81		479	555	1
5420	400 watt metal halide	+-		2.40	3.330 2.500	$\vdash$	398	61		459	525	1
5430	150 watt high pressure sodium			3.20	2.960		428	72		500	575	1
5440	250 watt high pressure sodium	+-		2.70		$\vdash$	454	81		535	620	1
5450	400 watt high pressure sodium	1	<b>†</b>	2.40	3.330	١ ،	454	31		•	0.0	
		+-										Ħ
U010	LAMP8	1.	et		8	С	348	(195)		543	670	
0080	Fluorescent, rapid start, cool white, 2' long, 20 watt		Elec	1 20		H	198	215		413	535	٦
0100	4' long, 40 watt .			.90	8.890		442	215		657	805	
0120	3' long, 30 watt	+	$\vdash$	.80	10		874	245		1,119	1,325	٦
0150	U-40 watt	1		.90	8.890		270	215		485	615	
0170	4' long, 35 watt energy saver	+	+-	.90	8.890		618	215		833	995	٦
0200	Slimline, 4' long, 40 watt			.80	10	1	577	245		822	990	
0300	8' long, 75 watt	+-	+	.80	10		603	245		848	1,025	_
0350	8' long, 60 watt energy saver	1		1	8.890		750	215		965	1,150	
0400	High output, 4' long, 60 watt	-	+-	.90	10		775	245	<u> </u>	1,020	1,200	_
0500	8' long, 110 watt	1		.80	8.890		1,285	215		1,500	1,725	
0520	Very high output, 4' long, 110 watt	+	+	_	11.430	1	1,285	275		1,560	1,825	_
0550	8' long, 215 watt			.70	26.670	1 1	2,142	645		2,787	3,300	
0600	Mercury vapor, mogul base, deluxe white, 100 watt	+-	+	.30	26.670	_	1,663	645		2,308	2,775	_
0650	175 watt	1		.30	26.670		2,968	645		3,613	4,225	
0700	250 watt	+	+-	.30			2,340	645		2,985	3,525	_
0800	400 watt			.30	26.670	1	5,100	970		6,070	7,025	
0900	1000 watt		+	.20	40		3,749	645		4,394	5,075	_
1000	Metal halide, mogul base, 175 watt			.30	26.670		4,712	645		5,357	6,125	
1100	250 watt	-	+	.30	26.670 26.670	_	4,386	645		5,031	5,775	_
1200	400 watt			.30	40	1	9,894	970		10,864	12,300	
1300	1000 watt	+	╀	.20	40	+	9,960	970		10,930	12,400	_
1320	1000 watt, 125,000 initial lumens			.20			9,268	970		10,238	11,600	
1330	1500 watt		+	.20	26.670	1-	4,712	645	<b></b>	5,357	6,125	_
1350	Sodium high pressure, 70 watt		1	.30	1		4,712	645		5,516	6,300	
60	100 watt	-	+	.30	26.670	-	5,059	645		5,704	6,525	-
1370	150 watt			.30	26.670		1	645		6,025	6,875	
1380	250 watt	-	+	.30	26.670		5,380	645	+	6,372	7.250	-
1400	400 watt			.30	26.670	'l	5,727	970		14,322	16,100	
1450	1000 watt		+	.20	40	+	13,352	645	+	4,608	5,300	-
1500	Low pressure, 35 watt			.30	26.670	1 1	3,963 4,386	645	1	5,031	5,775	
			- 1	.30	26.670		A . 000	1 045		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	31110	_



CODE

#### CONTRACTOR PRIC

GP-N-3 9 of 10 stor

STD. PKG5

PKGS WGHTEN LIST

#### REFLECTA-STAR"-COMPACT FLUORESCENT FLOODLIGHT-SERIESH

10513T	64.32 64.32 64.32
PL5 5.25° Diameter Reflector   10   11	64.32
PL9Q 3.75" Diameter Reflector 10 11 10924 PL9Q 4.50" Diameter Reflector 10 11 10925 PL9Q 5.25" Diameter Reflector 10 11 11324 11325 PL13Q 5.25" Diameter Reflector 10 11  Gold reflector options available in all units ADD:  Pink Lens 10 1  Warmtons Lens 10 1	
PL9Q 4.50* Diameter Reflector 10 11 10925  PL9Q 5.25* Diameter Reflector 10 11 11324 11325  PL13Q 4.50* Diameter Reflector 10 11 PL13Q 5.25* Diameter Reflector 10 11  Gold reflector options available in all units  ADD:  Pink Lens 10 1 Warmtone Lens 10 1	6482
10925 PL9Q 5.25" Diameter Reflector 10 11 11324 PL13Q 4.50" Diameter Reflector 10 11 PL13Q 5.25" Diameter Reflector 10 11 Gold reflector options available in all units  ADD:  Pink Lens 10 1 Warmtone Lens 10 1	73.14
PL13Q 4.50* Diameter Reflector 10 11 11325  PL13Q 5.25* Diameter Reflector 10 11  Gold reflector options available in all units  ADD:  Pink Lens 10 1  Warmtone Lens 10 1	73.14
PL13Q 5.25" Diameter Reflector  Gold reflector option  available in all units  ADD:  Pink Lens  Warmtons Lens  10 11  10 1  10 1	
Gold reflector options available in all units ADD:  10003-P* Pink Lens 10 1 10003-W Warmtons Lens 10	74.644
available in all units ADD:  10003-P* Pink Lens 10 1 10003-W Warmtons Lens 10	74.64 37.32
10003-W Warmtons Lens 10	5.25 2.63
1000011	435 7 218
AGGG ME FILL TO THE TAXABLE TO THE T	4.35
1000	4.35 2.18
1000011	3.00
10003-CF Clear Frost Lens (Standard) 10 1 1 10003-C 10003-C 10 1 10 1	3.00
10003-U Ultraviolet Filter Insert Disk 10 1	4.35 2.18
XT-125 Socket extender—extends unit 1.25" 25 4	4.95 2.48

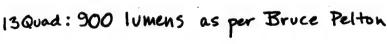
<sup>\*</sup>IMPORTANT: To order optional lenses or filters, please specify reflector size. The last digit of the product code number for the Reflect-A-Star Series indicates the reflector diameter. "3" indicates 334," "4" indicates 41/2" and "5" indicates 51/4."

#### RECESSED DOWNLIGHT KIT

5111325 5121325 5131325 Clear Reflector Trim **Gold Reflector Trim Black Reflector Trim** 

88.32 12 70 176.64 176.64 88.32 12 70 176.64

- 20,58%- 00



<sup>\*</sup>The recessed downlight kit consists of a frame-in kit, reflector trim in clear, gold or black Alzak® aluminum and a Reflect number 11325 with standard reflector and lense. The second second

<sup>&</sup>quot;Fixture price includes lamp: "PL" or "PLQ" refers to lamp type only. GE, Osram; Philips or Sylvania lamps will be supplied at the of Lumstech. All Reflect-A-Star" and MicroLamp" units are @ and CSA Listed.

#### MicroLamor -- FLUORESCENTADAPTOR SERIES

The second of th

20510 20710 20910		PL5 PL7 PL9	50 28 50 28 50 28	28.17 14.09 14.09 14.09 14.09 14.09
20920 21320		PLQ9	50° 28 50° 30	39.03 19.52 39.03 19.52
FLUORES	CENT REPLACEMENT LAMPS			
40510 40710 40910 41310		5W Fluorescent "PL" lamp 7W Fluorescent "PL" lamp 9W Fluorescent "PL" lamp 13W Fluorescent "PL" lamp	50 4 50 4 50 5 50 6	9.00 4.50 9.00 4.50 io 9.00 4.50 io 9.75 4.88

#### **CONDITIONS OF SALE**

9W Fluorescent "PLQ" lamp

13W Fluorescent "PLQ" lamp

#### ORDER ACCEPTANCE

Orders are subject to approval at Lumatech corporate headquarters.

#### PRICES

40920

41320

Prices are subject to change without notice. Lumatech reserves the right to accept and bill all orders at prices in effect at the time of the shipment.

#### TERMS

Net 30 days on approved credit only. 11/2% per month will be assessed on past due invoices. Any account submitted for collection is subject to reasonable attorney fees and costs.

#### FREIGHT

Transportation costs will be pre-paid and billed F.O.B. Oakland, California.

#### RETURNS

No merchandise may be returned without prior written authorization. Authorization may be requested within 30 days from the date of original shipment. All returns will be subject to a minimum handling and factory inspection charge of 25% of invoiced amounts, plus freight, except on products considered by Lumatech to be defective in workmanship and materials.

#### CLAIMS FOR DAMAGE OR LOSS IN SHIPMENT

It is the responsibility of the consignee to file a claim with the transportation company in the event of lost or damaged merchandise. Immediately upon receipt of the shipment, the consignee should check for loss or damage. In the event such has occurred the consignee should file a claim with the transportation company promotiv.

#### CANCELLATIONS

Orders are not cancelable except on payment for all costs incurred, engineering work performed, any materials purchased or commitments made on the part of Lumatech. Lumatech reserves the right to assess a minimum cancellation charge equal to 25% of the original purchase price of the order placed by the customer.

#### PRODUCT SPECIFICATIONS

Subject to change without notice.

#### CATALOG ERRORS

Every effort is made on the part of Lumatech Corporation to provide accurate pricing, dimensional and physical description information, etc. in our literature and price lists. However, as this information is subject to change without notice, we cannot accept the responsibility for any loss or damages due to informational errors in our publications. We invite your inquiry regarding up to date information.

7.88

15.75

#### MINIMUM ORDER

Minimum net invoice amount is \$50.00. Any order under \$50.00 is subject to a \$10.00 handling charge.

#### LIMITED WARRANTY

The REFLECT-A-STAR\* and MicroLamp\* series fixtures are warranted to be free from defects in workmanship and materials, as manufactured, for a period of three years from the date of original invoice. Lamps are warranted for 90 days only.

Our invoice covers only replacement or repair at our factory of the defective part(s), to the original purchaser, and excludes any responsibility for labor or freight expense incurred by the purchaser or others, for servicing such claim during the warranty period. Lumatech reserves the right to issue credit, repair or replace defective merchandise, at our option, upon receipt of written notification by the original purchaser of the alleged defect, within the warranty period. Lumatech further reserves the right to examination of the alleged defective product, or proof satisfactory to Lumatech of the defect. This limited warranty is in lieu of all other responsibility for labor costs in connection with the installation, removal or replacement of warranted products, or for any consequentials—damages. Lumatech further reserves the right to refuse to honor the above warranty for any product(s) altered, improperly installed, or installed in application for which not intended.

For Authorized Dealer Contact:



REYNOLDS.	SMITH	AND	HILLS					
ARCHITECTS	· ENGINEE	RS · PL	ANNERS					
INCORPORATED								

SUBJECT RAAP Lighting Projects

Serening Calcs.

Designer T. Todd

Date

AEP NO 290 6: 79000

DATE

GP-N-4 GROUP RELAMFING PROJECT:

Reglace all 40 W fluorescent lange with 34 W fluorescents

Energy Savings = 6 W x 24 hr x 260 days = 37.4 km = 0,128 HHEtu yr yr yr (assume railart was some energy

Cost savings = 37.4 this x \$0.03026 = \$1.13

Cost of relamping (1980 Means Electrical):

Mat'l = \$2.70 , Labor = \$2.15

Construction cost =  $(1.045 \times ^{\frac{1}{2}} 2.71 + 1.2 \times ^{\frac{1}{1}} .70) - 1.2)7$ 

Simple panjoack = \frac{\frac{17.45}{1.13/47}}{1.13/47} = 6.6 yr

life of lamp = 20,000 hr x yr = 3.2 yr 6.6 yr payback

=> Not recommended since life of lamp is less than payback.

HE	6 100 Lighting	AP	DW	DAILY	MAN- HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL OAP	1
		-	EW				479	24	EQUIP.		565	ł
100	175 watt metal halide		ec	8	1	Ea.	500	24		503 524	585	ı
110	250 watt metal halide	+	$\vdash$	8	1		535	24		559	625	1
20	150 watt high pressure sodium			8	1		556	24		580	645	1
30	250 watt high pressure sodium	+	$\vdash$	8	-;-		525	24		549	615	1
140	72 H 18" sq., 400 watt metal halide			8	- ;		556	24		580	645	ı
150	250 watt high pressure sodium	+	$\vdash$	8	-	-	581	24		606	675	1
160	400 watt high pressure sodium	١ '	'	°	' I	•	361	27		343	0/3	ı
190	Portable rectangle, 6" high 13.5" x 20"	1 E	loo l	12	.667	Ea.	293	16,15		309.15	345	1
200	175 watt metal halide	5	EC.	12	.667	<b>Za</b> .	314	16.15		330.15	370	I
210	250 watt metal halide	+	$\vdash$	12	.667	_	335	16.15		351.15	390	1
220	150 watt high pressure sodium			12	.667		360	16.15		376.15	420	I
230	250 watt high pressure sodium	+	$\vdash$	12	.667	_	365	16.15		381.15	425	1
240	8" high 18" x 24", 400 watt metal halide			12	.667		376	16.15		392.15	435	١
250	250 watt high pressure sodium	╂┥	$\vdash$	12	.667		398	16.15		414.15	460	ł
260	400 watt high pressure sodium	11	1 1		.667		324	16.15		340.15	380	Ì
270	Portable square, 15" high 13.5" sq., 175 watt metal halide	╂┵	-	12		_					435	1
280	250 watt metal halide		il	12	.667 .667		376 360	16.15 16.15		392.15 376.15	420	
290	150 watt high pressure sodium	╂╌┤	$\vdash$	12				16.15		402.15	450	ł
300	250 watt high pressure sodium	1	il	12	.667		386 355	61		416	480	ı
100	Pendent 16" round/square, 175 watt metal halide	+	-	3.20	2.500			72		442	515	1
110	250 watt metal halide		l	2.70	2.960		370 398	81		479	555	I
120	400 watt metal halide	╂┵	$\vdash$	2.40	3.330	-	398	61		459	525	1
130	150 watt high pressure sodium			3.20	2.500		428	72		500	575	ı
140	250 witt high pressure sodium	╂┤	$\vdash$	2.70	2.960	$\dashv$	454	81		535	620	1
50	400 watt high pressure sodium	١ ١	'	2.40	3.330	*	404	01		333	020	1
		+-	-									4
	LAMP8	١,,	100		8	С	348	195		543	670	
080	Fluorescent, rapid start, cool white, 2' long, 20 watt	1 E	:IOC	1 00	8,890	-	198	215		413	535	1
100	4' long, 40 watt			.90 .90	8.890		442	215		657	805	
120	3' long, 30 watt	+	$\vdash\vdash$	-		_	874	245		1,119	1,325	1
150	U-40 watt			.80	10		(270)	(215)		485	615	1
170	4' long, 35 watt energy saver	+		.90	8.890 8.890	-	618	215		833	995	1
200	Slimline, 4' long, 40 watt			.90 .80	10		577	245		822	990	
300	8' long, 75 watt	+		_		_				848	1,025	1
350	8' long, 60 watt energy saver			.80	10		603	245 215		965	1,150	
400	High output, 4' long, 60 watt	+	$\vdash$	.90	8.890	-	750 775	245		1,020	1,200	+
500	8' long, 110 watt			.80				215		1,500	1,725	
520	Very high output, 4' long, 110 watt	+	Н	.90	8.890		1,285	275		1,560	1,825	-
550	8' long, 215 watt			.70	11.430		1,285	645		2,787	3,300	
500	Mercury vapor, mogul base, deluxe white, 100 watt	+	$\vdash$	.30	26.670		2,142			2,308	2,775	-
550	175 watt			.30	26.670		1,663	645		3,613	4,225	Ì
700	250 watt	+	$\vdash$	.30	26.670		2,968	645		2,985	3,525	4
300	400 watt			.30	26.670		2,340	645				
200	1000 watt	+	$\vdash$	.20	40		5,100	970		6,070	7,025 5,075	4
000	Metal halide, mogul base, 175 watt			.30	26.670		3,749	645		4,394		
100	250 watt	$\bot$	$\vdash$	.30	26.670	-	4,712	645		5,357	6,125	-
00	400 watt			.30	26.670		4,386	645		5,031	5,775	
200	1000 watt	$\bot$		.20	40		9,894	970		10,864	12,300	-
20	1000 watt, 125,000 initial lumens			.20	40		9,960	970		10,930	12,400	
30	1500 watt	4	$\vdash$	.20	40		9,268	970		10,238	11,600	4
150	Sodium high pressure, 70 watt			.30	26.670		4,712	645		5,357	6,125	
0	100 watt	$\bot$		.30	26.670		4,871	645		5,516	6,300	4
70	150 watt			.30	26,670		5,059	645		5,704	6,525	
80	250 watt	$\bot$	Ш	.30	26.670		5,380	645		6,025	6,875	4
000	400 watt			.30	26.670		5,727	645		6.372	7,250	
50	1000 watt	$\bot$	$\sqcup$	.20	40		13,352	970		14,322	16,100	4
00	Low pressure, 35 watt			.30	26.670		3,963	645		4,608	5,300	
			. 1	.30	26.670	1	4,386	645		5,031	5,775	- 1

∔FOOT, I	RAPID-START LAMPS	ą.	E/	A STATE OF THE PARTY OF THE PAR	A STATE OF THE STA	THE PARTY OF THE P	Se Se Se Se Se Se Se Se Se Se Se Se Se S	a rate de la	S. S. Mark	THE AND A
General			3/ 3		<b>5</b>	20	8 E	3	300	Salar Bay Salar
Electric	F40CW Standard			0 69.			4,15	20.0	m	- \$2.27 _
	P40LW/RS/WMII Watt-Miser II.	3	2.42			% 62	4,15			
									00 \$1.	
							-,	,-		92 \$4.29 12.6 month
	F32T8/SP41/RS (not a retrofit; see footnote).			85.						- \$10.28
GTE Sylvania	F40CW Standard		2,770	69.	•			20,0	~	92 \$3.66 8.7 months
						% 62 % 62		,		\$2.27 —
	F40/D41/SS (LWX) Designer SuperSuper	34	2,575							
					_	67	4, 100			
							4,200	20,00	0 51.	
	FO37 A1K/Octoon	32	2,600				4,100 3,100	,		92 \$4.42 13.4 months
	F40CW Cool White Standard F40/41U Ultratume Trichromatic Standard	32	2,600	81.3			4,100			
N.A. Philips Lighting Corp.	FIOCW Cool White Standard	70	2,770	69.3	****	-		an far de '		92 \$3.67 8.7 months
menting corp.	FM/SPECAL SPECAL Standard	40	2,935			67 85	4,100	20,00		\$2.26
	F40/SPEC41 SPEC 41 Standard. F40AX41 Advantage X Trichromatic Standard.			73.0	105%		4,100 4,100	20,00		\$6.95
							4,100	24,00		9.2
				72.4			4,100	~ 24,00		\$5.79
	P40/SPEC41/RW/FW-II SPEC 41 Feet O Watt.	34	2,650	77.9			4,100	20,00		
			2615	76.9		70	4,100	20,00		
			2,620 2,650	77.0			4,100	20,000	\$1.4	4 \$3.38 9.3 months
S-FOOT, SI	PO32/41 Octolume (Not a retrofit— see footnote).	32	2,650	77.9			4,100	20,000		
	MUNE LAMPS	1					4255	,	71.4	4 _ \$3.65; 11.6 months
General Electric	F96T12/CW Standard	75	5,800	77.3						
Ciecuit			5,150	77.3 85.8	88.8%	62 62	4,150	12,000	-	\$5.76 —
	P%T12/LW/WMII Watt-Miser II. P%T12/SP41/WM Watt-Miser.	60	5,520	92.0	95.2%		4,150 4,200	12,000 12,000		TOTAL OF INTOTAL
CTF Colonia			5,275	87.9	90.9%		4,100	12,000	\$3.60 \$3.60	
GTE Sylvania			5,800	77.3		ige dy', a live	to the a			30.37 6.7 months
	P96T12/CW/SS SuperSaver.	60	5,060	84.3	87.2%	62 62	4,200	12,000	_	\$5.59
	P96T12/LW/SS SuperSaver P96T12/D41/SS (LWX) Designer SuperSaver	60	5,380	89.7	92.8%	. 48	4,200 4,150	12,000	\$3.60 \$3.60	
N.A. Philips	P96T12/D41/SS (LWX) Designer SuperSaver	Cymrie OU	5,380	89.7	92.8%	67	4,100	12,000	\$3.60	
Lighting Corp.	F70112/CW Cool White Standard		5,800	77.3		67	4.500	٠٠٠ سناه		A STATE OF THE PARTY OF THE PAR
	P96T12/41U Ultralume Trichromatic Standard. P96T12/SPEC 41 Standard. P96T12/CW/EW Cool White For Control		5,875	78.3	101.3%		4,100 4,100	12,000 12,000	_	\$5.75 —
			5,820	77.6	100.3%	70	4,100	12,000	_	\$13.76 \$8.72
			5,150 5,345	85.8 89.1	88.7% 92.2%	67	4,100	12,000	\$3.60	\$6.66 3.03 months
	P96T12/SPEC41/EW SPEC 41 Econ-O-Watt. P96T12/LW/EW Lite White Econ-O-Watt.	60	5,335	88.9	92.0%	85 70	4,100 4,100	12,000	\$3.60	\$13.17 immediately
8-FOOT, HIG	H-DUTRUT LANGE	60	5,380	89.7	92.8%	51	4,100	12,000	\$3.60 \$3.60	\$8.36 immediately \$8.37 8.7 months
. General		F .							12.00	30.37 0.7 months
Electric	P96T12/CW/HO Standard	110	8,005	72.8		62				
	P96T12/LW/WMII Watt-Miner II	95	7,220	76.0	90.2%	62	4.150 4.150	12,000	\$3.60	* \$6.74
	F%T12/SP41/WM Watt-Miser	95	7,655	80.6	95.6%	49	4,200	12,000	\$3.60	\$6.96 0.7 months \$7.55 2.7 months
GTE Sylvania			7,840	82.5	97.9%	70	4,100	12,000	\$3.60	\$8.81 6.9 months
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	F%T12/CW/Standard. F%T12/CW/SS SuperSaver. F%T12/LW/SS SuperSaver.		8,000	72.8	_	62	4,200	12.000		
			7,220	76.0	90.3%	62	4,200	12,000	\$3.60	\$6.95 — \$7.17 22 days
	Designer SuperSaver	. 95	7,655 7,655	80.6 80.6	95.7% 95.7%	48	4.150	12.000	\$3.60	\$7.78 2.8 months
N.A. Philips	POST12/CW/HO Cont Main Co.		-,		73./76	67	4,100	12,000	\$3.60	\$8.84 6.3 months
Lighting Corp.	F701 12/41U/MC) [/ltralume Trichman-si- Ci-		8,005	72.8	_	67	4,150	12,000	_	\$6.73
			8,180 8,160	74.4 74.2	102.2% 101.9%	85	4,100	12,000	_	\$17.76
	P96T12/41U/HO/EW Liltrahima Form O Watt	. 95	7,220	76.0	90.3%	70 67	4,100	12,000 · 12,000	=	\$9.28
,			7,780	81.9	97.2%	a: 85	4,100	12,000	\$3.60 \$3.60	\$6.95, 0.7 months \$17.31 immediately
	P96T12/LW/HO/EW Lite White Econ-O-Watt.	. 95	7,650 7,660	80.5 80.6	95.6% 95.7%	70	4,100	12,000	\$3.60	\$8.80 immediately
8-FOOT, ULTR	A-HIGH-OUTPUT LAMPS				73.77	51	4,100	12,000	<b>\$3.60</b>	\$7.54 2.7 months
Electric	F%T12/CW/1500 Standard F%T12/CW/1500/WM Watt-Miser F%T12/LW/1500/WMI Watt-Miser	. 215	11,050	51.4	_	62	4 150			
	F96T12/LW/1500/WMIT Watt Misser II	. 185	10,140	54.8	91.8%	62	4, 150 4, 150	9,000	\$12.59	- ·
			10,765	58.2	97.4%	49	4,200	9,000	57.20 57.20	\$12.96 .6 months \$18.49 9.8 months
	F96PG17/CW/WM PG Watt-Miser. F96PG17/LW/WMII PC Watt-Miser.	. 185	12,160 10,360	68.6 56.0	110.0% 93.8%	62		12,000	_	\$14.44
	Wall-Miser.	. 185	11,025	59.6	99.8%	62 49		12,000 12,000	\$7.20	\$15.55 1.5 months
GTE Sylvania	P96T12/CW/VHO Standard.	215	11 050	-		Seimer -			\$7.20	\$19.28 8.1 months
	P96TL2/CW/VHO/SS Super Saves. P96TL2/LW/VHO/SS Lite White Super Saves.	195	11,050 10,740	53.5 55.1	92.49	ે 62	4,200	10,000	-	\$12.96
	the Super Saver	. 195	11,400		93.4% 99.1%	. 62 48		0,000	\$4.80	\$13.35 30 days ::
	DETINGUIDE CONTRACTOR AND AND AND AND AND AND AND AND AND AND					-		0,000	4.80	\$19.24 15.7 months
Philips	F70112/CYY/VHC11 onl White Standard	215			Comment of the Commen	and the same of the	reform		سريسي ده	
Philips Lighting Co.	P96T12/CW/VHO Cool White Standard P96T12/CW/VHO/EW Cool White Econ-O-Watt. P96T12/LW/VHO/EW Lite White Econ-O-Watt	215 185		53.5	93.7%	67 67		2,000	er i i i i i i i i i i i i i i i i i i i	\$14.79

General Electric Ca., Lighting Business Group, Cleveland, Ohio 4412. Company recommends any standard or energy-ericaent magnetic ballast with a high power factor. Operation on low power factor ballasts, dimming and emergency lighting systems (unless approved by the system mendacturer) or operation on reduced current reduced light output ballasts in not recommended for energy-serving lamps. FACBX (BLAX) for use with RS ballast designed for this lamp. All statistics based on Cool White or equivalent Light White phosphore. FAIT lamps are served with RS ballasts designed for this lamp.

GTE Products Carp., Sylvania Lighting Center, Danvers, Mass. 01923. Company recommends any ANSI-approved standard or energy-arving balast. Oc-tron lamps (1-stch disassess—type 78) are for use with

T32TB Rapid Start beliast (megnetic or electronic) only.
North American Philips Lighting Corp., 200 FrankBr Square Drive, Someraet, N. Y. 08873. Econ-O-Wert
lamps are only recommended for use on high-powerfactor, lead indoor ballasts that meet ANSI standards.
The tamps are not recommended for use on of raity
area, or locations where the temperature is less than old
degrees F. Also, they should not be operated on
narmal power factor ballasts, reduced light or reduced
current ballasts, dissensing ballasts or emergency system
inverteer ballasts. PO32 Octobrate lamps are operated
on Rapid Scart ballasts for 32-wait, T8 sources.

In applications for all energy-efficient lamps, the ambient temperature must be at least 60 degrees. Efficiency figures above do not include energy consumed or loss by the bullest.

The "Mean Lumens" column lists the mean (mass-tained) lumens enutted by the lamp at 40 percent of its resed lift. The "Lumens Per Walf" column uses the snean humens to figure the lamp's efficiency.

The closer to 100 the "Color Rendering Index" (CRD, the closer is to reproducing colors accurately, as bould match other lamp in the room; incandescent lamps are about 2.500 Kervins and natural swittlepth is about 5.500 to 6.500 Kervins. And natural swittlepth is about 5.500 to 6.500 Kervins. And natural swittlepth is about 5.500 to 6.500 Kervins. On the color of the lamps listed above is based on 3.000 hours of lamp operation per year host based on 3.000 hours of lamp operation per year and an electricity rate of 8 cents per kilowatt hour (Kwh). The "Psyback" listed above is based on the coast pressum of the energy-efficient lamp over the

standard lamp.

The prices of the above lamps are suggested lies prices to the end user for a single lamp. Discounts are usually available with quantity purchases.

The above lating is a representative sample from a range of namidativerses. Space limitations prevent all compenses and models from being listed. EUN takes no responsibility for susceptication of products, aincredate is based on manufactories\* distournments.

Occapancy passess and head pumps will be featured in upcoming Product Guides. Manufacturers are encountinged to send model information including prices in upcoming Product Guides. Manufacturers are encountinged to send model information including prices in upcoming Product Guide Editor. Energy User News., 7 East 12th St., New York, N.Y. 10020; or so cal (212) 741-4468.

St., New York, N.Y. 10020; or so cal (212) 741-4468.

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## REYNOLDS, SMITH AND HILLS ARCHITECTS • ENGINEERS • PLANNERS INCORPORATED

SCREENING OCATES,
DESIGNER T. Todd

AEP NO 290 2379 000 SHEET OF 7

17 11 5

CHECKER

<u>Bailast réplacement and group rélamping project</u>

- -Replace standard 40 W lamps with 34 w watmisir plus lamps, and replace standard ballasts with wattmiser ballasts. Light level will be 90% of original.
- Assume 4 hr/day, 5 day/week speration
- Calculations are for 2-lamp, 1-ballast fixtures.

Evergy savings =  $\frac{181 - 127 \text{ W}}{2}$   $\times 24 \text{ hr} \times 260 \text{ days} = 168.5 \text{ keVh}$ 

Cost savings = 168.5 kurn x \$0,0300 = \$5.10 yr

 $Matl = 2($2.70) \times 1.002 + $23.04 = $28.45$ 

Labor =  $[2(2.15) + 121] \times 0.683 \times 1.2 = 120.74$ 

Construction Cost =  $[(1.045 \times {}^{t}78.45) + (1.7 \times {}^{t}78.74)] \times 1.507$ = [\*87.3]

Simple payback = \frac{182.31}{5.10/yr} = 16.1 yr > 10 yr

# GP-N-5

# GENERAL 🐲 ELECTRIC

# THE NEW AGE OF 4-FOOT FLUORESCENT LIGHTING

# -THE COMBINATIONS

			BALLASTS		FIGNAMACA
LAMPS	STANDARD	WATT-MISER"	MAXI-MISER"	OPTIMISER	(ELECTRONIC)
STANDARD	Low efficiency High watts	Good efficiency Moderate watts	Good efficiency High light output	High efficiency Low watts	U.L. listed, however FE-MM is recommended.
	Watts = 181 Light = 100%	Watts = 163 Light = 100%	Watts = 168 Light = 104%	Watts = 135 Light = 92%	Watts = NA Light = NA
WATT-MISER®	Moderate efficiency Moderate watts	Very good efficiency Low watts	Very good efficiency Good light output	Very high efficiency Lowest watts LOWEST OP COST	Not recommended Use FE-WM
	Watts = 159 Light = 91%	Watts = 140 Light = 90%	Watts = 150 Light = 97%	Watts = 116 Light = 84%	
WATT-MISER® PLUS	Good Efficiency Low watts	High efficiency Very low watts LOWEST OWN & OP COST	High efficiency Low watts	Not recommended	Not recommended Use FE-WM
	Watts = 144 Light = 91%	Watts = $127 \text{ Light} = 90\%$	Watts = 137 Light = 97%		
MAXI-MISER"	Moderate efficiency High light output	Good efficiency High light output LOWEST COST OF LIGHT	Very good efficiency Highest light output LOWEST COST OF LIGHT	High efficiency Good light output LOWEST COST OF LIGHT	Not recommended Use FE-MM
	Watts = 186 Light = 106%	Watts = $167 \text{ Light} = 106\%$	Watts = 173 Light = 111%	Watts = 140 Light = 98%	
OPŢIMISER	ON	ON	ON	Very high efficiency Very low watts  LOWEST OP COST  Watts = 120 Light = 88%	ON
E-TYPE WAŢT-MISER®	ON	ON	ON	ON	Highest efficiency* Lowest watts LOWEST OP COST  Watts = 117 Light = 90%
E-TYPE MAXI-MISER"	ON	ON	ON	Q	High est efficiency* High light output Watts = 134 Light = 101%

NOTE: Applies to performance in 4-lamp 2×4 recessed prismatic troffers, energy cost of 8c/KWH and 8000 burning hours per year. Light values are based on tumens of \$P35 lamps. Conclusions shown in CAPS assume typical costs and can vary—especially with energy rates. Where more than one combination is shy "LOWEST..." their costs are nearly equal and significantly lower than the rest. "LOWEST OWN" OP and "LOWEST OP COST" are costs per fixure; "LOWE OF LIGHT" is total cost per unit of light.

\* The Performance system will typically be LOWEST COST OF LIGHT at higher energy rates and longer burning hours.







#### YOUR BEST SOURCE FOR BALLASTS AND ENERGY SYSTEMS

General Electric Ballasts and Energy Systems are available locally from your authorized General Electric stocking distributor. To serve your lighting needs, most distributors can provide you "off-the-shelf" delivery of the most popular ballasts used today. Select the ballast or system right for your application—then contact your GE distributor for prompt and courteous service. Quick Reference Guide to the Most Popular Standard & Energy Saving Ballasts

FOR FLUORESCENT LAMPS
-----------------------

			RESCENT LAM	P5	Lamps Operated by Bailast
Product Code	Catalog Number	Line Volts	Pkg. Qty.	Ballast Type	Number & Type
	PE	RFORMANCE"	ELECTRONIC E	BALLASTS	
14868	E40-120-2	120	20	PERFORMANCE	(2) FE40/WM or (2) FE40/MM or
14869	E40-277-2	277	20	PERFORMANCE	(2) F40T12/RS
14870	E40-120-3	120	20	PERFORMANCE	(3) FE40/WM or (3) FE40/MM or
14871	E40-277-3	277	20	PERFORMANCE	(3) F40T12/RS
		T8 R	APID START		
16764	8G4126W18	120	20	T-8 WATT-MISER	(2) F32T8RS
16767	8G4136W18	277	20	T-8 WATT-MISER"	or (2)F25T8RS
10/0/		RO-MAGNETIC			
			10	OPTIMISER	(2)
14282	M28-120F+	120 1 <b>20</b>	10	Standard	F30 Rapid Start
46067	8G3971WF	120	10	Low-Temp.	Standard
46035	8G3905WF*		10	OPTIMISER	or
14283	M28-277F+	277 277	10	Standard	WATT-MISER*
46070	8G3972WF		RAPID START	Stardard	WATT IMPELL
				OPTIMISER	(1)
14284	M28-120-1F	120	10 10	MAXI-MISER" II	F40 Rapid Start
48582	8G1078WF	120	, , , ,	MAXI-MISER II	Standard
48571	8G1074WF	120	10	Standard	or
45686	●8G1063WF	120	10		WATT-MISER
46075	8G5001WF*	120	10	Dimming	
45900	8G3688WF*	120	10	Low Temp.	OF SALANI MISER
45210	8G1075F*	120	10	Low Power Factor	F40 MAXI-MISER
14285	M28-277-1F	277	10	OPTIMISER	
48589	8G1088WF	277	10	MAXI-MISER II	
48585	8G1084WF	277	10	WATT-MISER	
45709	•8G1068WF	277	10	Standard	
		120	10	OPTIMISER	(2)
14282	M28-120F++		10	MAXI-MISER II	F40 Rapid Start
45204	8G1028WF++	120		CHATTL'HISED	Standard
45203	8G1024WF	120	10	Slandard	or
45201	•8G1022WF	120	10		VATT-WISER
46035	8G3905WF*	120	10	*Low Temp.	OF
46077	8G5007WF*	120	10	Dimming	F40 MAXI-MISER
14283	M28-277F++	277	10	OPTIMISER	F4U MAXI-MISEN
45208	8G1038WF++	277	10	MAXI-MISER II	
45207	8G1034WF	277	10	VATT-MISER	
45206	●8G1032WF	277	10	Standard	
14277	8G1324W**	120 277	20 20	ATT-MISER	(3) -40 WATT-MISER
14279	8G1334W**			71.14 17.21	-0 WAIT-MOEN
			TANT START	Chandred	(2)
45221	8G1600WF	120	6	Standard	F48T12, F40/IS,
45789	8G1628WF*	120	6	Low Temp.	F40T17/IS or
45812	8G1710WF	277	6	Standard	1
45791	8G1631WF*	277	6	Low Temp.	WATT-MISERS
45213	8G1008WF	120	6	MAXI-MISER II	(2)
45212	8G1004WF	120	6		F96/84/72T12
45215	●8G1011WF	120	6	Standard	Instart Start
45779	8G1490WF*	120	6	Low Temp.	or
	8G1018WF	277	6	MAXI-MISER II	WATT-MISERS
45219	8G1014WF	277	6	VATT-MISER	
45216		277	6	STD6 Leads	
45218	•8G1015WF	277	6	STD4 Leads	1
46954	•8G1899WF				(4)
45818 45821	8G1762WF 8G1764WF	120 277	6 6	Standard-0°F Standard-0°F	(1) F96/84/72T12 Instart Start
		HIGH (	OUTPUT 800m.a		
	8G3885WF	120	6	Standard	(2)
46066					
46966 46030	8G3900WF	120	6	Low Temp.	F48T12/HO or

Not approved for installation in the state of New York or California.

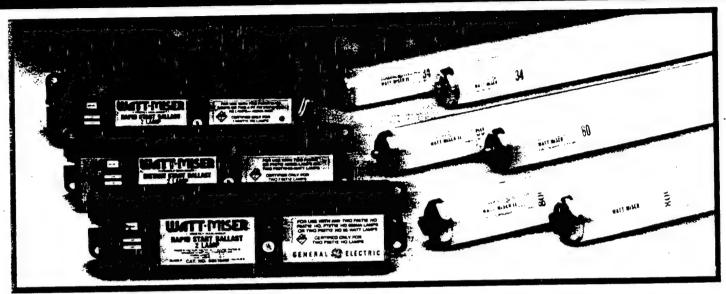
<sup>+</sup> U.L. listed only for reduced wattage, F30T12 lamps.

<sup>\*</sup> Not recommended for use with Watt-Miser and other reduced wattage type fluorescent lamps.

<sup>++</sup> Not recommended for use with Watt-Miser U-shaped lamps.

<sup>&</sup>quot;U.L. listed only for Watt-Miser and other reduced wattage lamps.

#### GE WATT-MISER BALLASTS USE LESS WATTS PER FIXTURE TO DELIVER HIGH ENERGY SAVINGS



#### **Watt-Miser Ballasts**

- Compatible with standard or energy-saving lamps
   (3-lamp WM ballast compatible only with ES lamps)
- Cooler operation extends ballast life
- · Dimensionally interchangeable with standard ballasts.
- CBM-certified by ETL with standard lamps.
   (3-lamp WM ballast not CBM certified)
- · UL-listed, Class P.

The GE Watt-Miser ballast is inherently more energy-efficient than a standard ballast. Even greater savings come from pairing Watt-Miser ballasts with today's popular reduced-wattage lamps. Watt-Miser ballasts are offered for 4' Rapid Start; 8' Instant Start; and 8' High Output applications. A 3-lamp Watt-Miser ballast in a standard rapid start case is available for use with four-foot energy-saving lamps. The chart shows fixture watts and energy \$ that can be saved by replacing standard lamps and ballasts with Watt-Miser ballasts and energy-saving lamps.

#### Lamp/Ballast System Replacement Chart

	Standard Sy	stem(1)		Watt-Miser System							
Fluorescent Fixture Type	Lamp Watt Type Fixtu		Lamp Type <sup>(2)</sup>	Watt- Miser Ballast <sup>(4)</sup>	Watts Saved Per Fixture	Energy <sup>(3)</sup> \$ Saved Per Fixture					
4-LAMP TROFFER	F40 F40 (34W)	181 159	F40LW/RS/WMII F40LW/RS/WMII	(2)8G1024W (2)8G1024W	41 19	\$ 9.84 \$ 4.56					
-LAMP TROFFER F40 149		F40LW/RS/WMII	(1)8G1024W and (1)8G1074W (1)8G1324W	40 43	\$ 9.60 \$10.32						
2-LAMP INDUSTRIAL	F40 F96T12 F96T12/HO	96 172 255	F40LW/RS/WMII F96T12/LW/WMII F96T12/LW/HO/WMII	8G1024W 8G1004W 8G1154W	25 46 56	\$ 6.00 \$16.56 \$20.16					
2-LAMP, SURFACE- MOUNT, WRAP AROUND	F40	82	F40LW/RS/WMII	8G1024W	16	\$ 3.36					
4-LAMP, SURFACE- MOUNT, WRAP AROUND	F40	165	F40LW/RS/WMII	(2)8G1024W	32	\$ 6.72					

<sup>)</sup> Fixture equipped with standard ballast and lamp shown.

<sup>2)</sup> Other energy-saving lamps may be used to obtain similar savings.

<sup>(3)</sup> Annual energy savings at 8° KWH; 3000 Hrs.—F40; 4500 Hrs.—F96.

<sup>(4)</sup> Ballast codes shown are 120-volt. For complete application information, see product tables.

	Lighting		DAILY	MAN-			BARE	COSTS		TOTAL	1
16	66 100 Lighting	CREV	W OUTPUT	HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL GAP	l
5100	175 watt metal halide	1 Ele	c 8	1	Ea.	479	24		503	565	ľ
5110	250 watt metal halide		8	1		500	24		524	585	1
5120	150 watt high pressure sodium		8	1		535	24		559	625	ı
5130	250 watt high pressure sodium		8	1		556	24		580	645	1
5140	72"H 18" sq., 400 watt metal halide		8	1		525	24		549	615	۱
5150	250 watt high pressure sodium		8	1		556	24		580	· 645	1
5160	400 watt high pressure sodium		8	1		581	24		605	675	ı
5190	Portable rectangle, 6" high 13.5" x 20"	'			l						_
5200	175 watt metal halide	1 Ele	c 12	.667	Ea.	293	16.15		309.15	345	1
5210	250 watt metal halide		12	.667		314	16.15		330.15	370	⅃
5220	150 watt high pressure acdium	1	12	.667		335	16.15		351.15	390	
	250 watt high pressure sodium		12	.667		360	16.15		376.15	420	
5230	8" high 18" x 24", 400 watt metal halide	+	12	.667		365	16.15		381.15	425	1
5240	250 watt high pressure sodium		12	.667		376	16.15		392.15	435	
5250	400 watt high pressure sodium	1	12	.667		398	16.15		414.15	460	1
5260	Portable square, 15" high 13.5" sq., 175 watt metal halide	1	12	.667		324	16.15		340.15	380	
5270	250 watt metal halide	1	12	.667		376	16.15		392.15	435	1
5280	150 watt high pressure sodium		12	.667		360	16.15		376.15	420	
5290	250 watt high pressure sodium	1	12	.667		386	16.15		402.15	450	1
5300	Pendent 16" round/square, 175 watt metal halide		3.20	2.500		355	61		416	-480~	·
5400	250 watt metal halide		2.70	2.960		370	72		442	515	1
5410			2.40	3.330		398	81		479	555	
5420	400 watt metal halide 150 watt high pressure sodium	++	3.20	2.500		398	61		459	525	٦
5430	250 watt high pressure sodium		2.70	2.960		428	72		500	575	
5440	400 watt high pressure sodium	11	2.40	3.330		454	81		535	620	٦
5450	400 Watt high pressure socium	'	1 2.00	0.000	l '			1			
210	LAMP8	+		1							٦
0010	Fluorescent, rapid start, cool white, 2' long, 20 watt	1 Ek	ec 1	8	С	348	195	1	543	670	
0080		1 7	.90	8.890		198	215		413	535	
0100	4' long, 40 watt		.90	8.890		442	215		657	805	
0120	3' long, 30 watt	++	.80	10		874	245		1,119	1,325	
0150	U-40 watt		.90	8.890		270	(215)		485	615	
0170	4' long, 35 watt energy saver	+	.90	8.890		618	215		833	995	_
0200	Slimline, 4' long, 40 watt		.80	10		577	245		822	990	
0300	8' long, 75 watt	+	.80	10	1	603	245		848	1,025	_
0350	8' long, 60 watt energy saver		.90	8.890		750	215		965	1,150	
0400	High output, 4' long, 60 watt	-	.80	10	1	775	245		1,020	1,200	_
0500	8' long, 110 watt	11	.90	8.890		1,285	215		1,500	1,725	
0520	Very high output, 4' long, 110 watt	+	.70	11.430	_	1,285	275		1,560	1,825	_
0550	8' long, 215 watt		.30	26.670		2,142	645		2,787	3,300	
0600	Mercury vapor, moguł base, deluxe white, 100 watt	$\rightarrow$		26.670		1,663	645	_	2,308	2,775	_
0650	175 watt		.30	26.670		2,968	645		3,613	4,225	
0700	250 watt	-		_		2,340	645	<del>                                     </del>	2,985	3,525	_
0800	400 watt		.30	26.670	1		970		6,070	7,025	
0900	1000 watt	+	.20	40	+	5,100	645	-	4,394	5,075	-
1000	Metal halide, mogul base, 175 watt		.30	26.670		3,749			5,357	6.125	
1100	250 watt		.30	26.670	_	4,712	645		5,031	5,775	-
1200	400 watt		.30	26.670	"	4,386	645	1	10.864	12,300	
1300	1000 watt		.20	40	1	9,894	970	+	10,930	12,400	-
1320	1000 watt, 125,000 initial lumens		.20	40	1	9,960	970	1		11,600	
1330	1500 watt		.20	40	-	9,268	970		10,238 5,357	6,125	-
1350	Sodium high pressure, 70 watt		.30	26.670		4,712	645			6,300	
60	100 watt		.30	26.670	_	4.871	645		5,516		_
1370	150 watt		.30	26.670		5,059	645		5,704	6,525	
1380	250 watt		.30	26.670		5,380	645	+	6,025	6,875	-
1400	400 watt		.30	26.670	0	5.727	645		6,372	7,250	
1450	1000 watt		.20	40		13,352	970		14,322	16,100	
1500	Low pressure, 35 watt		.30			3,963	645		4,608	5,300	
		1	.30	26.670	ni L	4,386	545	1	5,031	5,775	

PTAC No. 865911

# TENTETTE reynolds; smith and hills

701 711	(813) Tampa				F-2-3-4-4
Local 396-7446 L			Recd_	Date-	A CANADA PROPERTY OF THE PARTY
T. Mas				- Jefson / Joe	House
Of G.E. Lamp Ma	rketing / Enginee	ring Reg	garding balla	sts.	
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Stan Jetson	provided cost	Joe	Howley ton	svided wattage	ج المالية العام الع
·		<del></del>			70
· utput, life	times				
4 ft			Cost	Life (functi	on of heat)
Standard	3G 10ZZWF	(5)	\$ 15.86	10-12 yr	2:3
Weffunser	8G 1024 WF	(w)	(\$ 21.94)	24 yr	The second secon
MaxinuserII	89 1028 WF	(M)	\$ 77.89	24 yr (e)	efficient.
Optimiser	M28-170F	(0)	\$34.10	30 yr	
- Maximiser	II - patent	ed, hu	Il light out	put using ever	gy Saving
	· · · · · · · · · · · · · · · · · · ·			1	_
	Lamp 5	, may	he airle to dela	enjo with this	one
- Optimiser	- patented	, newe	et, lowest	wattage input	
		<del></del>		0 10	
070					
Standard	861011WF	(5)	\$ 25,90	12 yr	AV AMORAL OF THE STATE OF THE S
Wattmiser	861004 WF	(w)	\$ 36.86	24 yr	•
Maximiser II	861008WF	(m)	\$ 39.17	24 W	
		minder order state or			

Distribution:

GP-N-5 1.707

1	66	Lighting	1							and supplied to an		
7			-	DAILY	MAN-			BARE			TOTAL	
4	16	66 100   Lighting	CREW	OUTPUT	HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL OAP	-
2.4	3020	Recessed, 200 watt	1 Elec	6.70	1.190	Ea.	51	29		80	99	130
	6030	Pendent, 200 watt		6.70	1.190		43	29		72	90 84	ł
I	6040	Wall, 200 watt		8	1		44	24 61		68 131	165	Ì
	6100	Fluorescent, surface mounted, 2 lamps, 41L, RS, 40 watt	<del>                                     </del>	3.20	2.500		70 139	88		227	280	1
	6110	Industrial, 2 lamps 4' long in tandem, 430 MA		2.20	3.640		100	100		200	260	İ
	6130	2 lamps 4' long, 800 MA	+	1.90	4.210 4.210	-	149	100		249	315	1
	6160	Pendent, indust, 2 lamps 41. in tandem, 430 MA		2.30	3.480		80	84		164	210	
	6170	2 lamps 4' long, 430 MA	-	1.70	4.710		109	115		224	290	1
1	6180	2 iamps 4' long, 800 MA		3.20	2.500		226	61		287	340	
	6200	Mercury vapor with ballast, 175 watt	-	0.20	2.000							1
1	6300	Explosionproof  Metal halide, ballast, ceiling, surface mounted, 175 watt	1 Elec	2.90	2.760	Ea.	668	67		735	835	
	6310 6320	250 watt		2.70	2.960		775	72		847	960	
	6330	400 watt		2.40	3.330		836	81		917	1,050	1
	6340	Ceiling, pendent mounted, 175 watt		2.60	3.080		640	75		715	815	
	6350	250 watt		2.40	3.330		745	81		826	940	1
	6360	400 watt		2.10	3.810		816	92		908	1,025	
	6370	Wall, surface mounted, 175 watt		2.90	2.760		698	67		765	865	1
	6380	250 watt		2.70	2.960		805	72		877	990	
	6390	400 watt		2.40	3.330	$oxed{oxed}$	856	81		937	1,050	4
	6400	High pressure sodium, ceiling surface mounted, 70 watt		3	2.670		724	65		789	890	1
	6410	100 watt		3	2.670		738	65		803	905	-
	6420	150 watt		2.70	2.960		765	72	İ	837	945	
	6430	Pendent mounted, 70 watt		2.70	2.960		678	72		750	850	
	6440	100 watt		2.70	2.960		698	72		770	875	
_	6450	150 watt		2.40	3.330		724	81		805	915	-
	5460	Wall mounted, 70 watt		3	2.670		750	65		815	920	1
	6470	100 watt	$\bot \bot$	3	2.670		775	65	-	840	945	-
	6480	150 watt		2.70	2.960		780	72		852	965 345	
	6510	Incandescent, ceiling mounted, 200 watt	+	4	2	$\vdash$	250	49		299	320	1
	6520	Pendent mounted, 200 watt		3.50	2.290	1	219	55		319	370	1
	6530	Wall mounted, 200 watt		4	2	-	270	72	-	1,382	1,550	1
	6600	Fluorescent, RS, 4' long, ceiling mounted, two 40 watt		2.70	2.960		1,310	88		2,003	2,225	
	6610	Three 40 watt	++	2.20	3.640		1.915	100		2,590	2,900	1
	6620	Four AU watt		1.90	4.210 3.480	1	1,390	84		1,474	1,650	
	6630	Pendent mounted, two 40 watt	+	1.90	4.210		2,020	100	<del>                                     </del>	2,120	2,375	7
	6640	Three 40 watt		1.70	4.710		2,570	115		2,685	3,000	
	6650	Four 40 watt	+	2.70	2.960		545	72		617	705	1
	6700	Mercury vapor with ballast, surface mounted, 175 watt		2.70	2.960		586	72		658	750	1
	6710	250 watt		2.40	3.330		714	81		795	905	7
	6740	400 watt Pendent mounted, 175 watt		2.40	3.330		550	81		631	725	
	6750	250 watt		2.40	3.330		561	81		642	735	1
	6760	400 watt		2.10	3.810		683	92		775	885	
	6770	Wall mounted, 175 watt		2.70	2.960		576	72		648	740	
	6780	250 watt		2.70	2.960		632	72		704	800	
	6790 6820	400 watt	1	2.40	3.330		750	81		831	945	
	6850	Vandalproof, surface mounted, fluorescent, two 40 watt		3.20	2.500		105	61		166	205	4
	6860	Incandescent, one 150 watt		8	1		45	24		69	85	
	6900	Mirror light, fluorescent, RS. acrylic enclosure, two 40 watt		8	1		61	24		85	105	4
	6910	One 40 watt		8	1		56	24		80	97	
_	6920	One 20 watt		12	.667		49	16.15	5	65.15	_	-1
Ø	7000	Low bay, aluminum reflector. 70 watt, high pressure sodium		4	2		298	49		347	400	
	7010	250 watt, high pressure sodium		3.20	2.500		535	61	-	596	680	-
	7020	400 watt, high pressure sodium		2.50	3.200	1	561	78		639	730	
	7500	Ballast replacement, by weight of ballast, to 15' high				1		-	-	40.40		-
	7520	Indoor fluorescent, less than 2 lbs.	1 Ele		.800	Ea.		19.4		19.40	29	
	7540	2 40W, watt reducer, 2 to 5 lbs.	1.	9.40	.851	1	17	21		38		25
_											15	95

YNOLDS, SMITH AND HILLS CHITECTS • ENGINEERS • PLANNERS INCORPORATED	SUBJECT RAAP Light Screening Caroner To	ting Projects US. Todd	AEP NO 290 0 SHEET DATE	379 000 of 10
GP-N-6 Replace explosion		indescents with	50 W HPS	fixtures
Note: 50 W HPS has equivalent lume	, been color co ns but yellow	rrected. 35 h ish light.	HPS would	provide
Energy savings = (	150 W - 70W)	x 24 hr x 365 day	<u>Clays</u> = 701	kwh yr
Energy Cost savings =	701 lash , 5	0.03026 = \$2 kwh	21. Z(	
Mat'l & Labor cost Savi	hgs = Incard. e 750 h	ost _ #PS cost 24,000 hr	× 8760 hr	
= (\$ Z,11 mate + \$1,20 750	Labor x 0.683 x 1.2 eg	-pt)_(*30 mat	e+ \$6.45 labor 4,000 hr	×0,683×1,2
x 8760 hr	= \$13.25 yv		the production of the producti	<b>-</b>
Total cost savings =	\$21.21 + \$2	$\frac{23.25}{9^{\prime}} = \frac{$44.2}{9^{\prime}}$	t6 :	
Matel cost = \$220 for	fixture w/long ×1.15	infration (1985	t vendor quo	te)
Labor cost = $$72 \times 1.$	2 exprost × 0.0	683 = \$59.01		
Construction cost = [ \$ 7	253 × 1.045) + (	59.01 × 1.2)] ×1	.507 = \$ 505	,
Simple payback = =	505 =	11.4 yr >1	0 yrs ⇒ not recom	- nouded

GP-N-6 p.2 of 10 ECP ENERGY CONSERVATION PRODUCTS, 511 CANAL STREET, NYC, NY, 10013—TEL (212)-925-5991

#### POWER CONSUMPTION AND LUMEN CUTPUT DATA

			TOTAL	LUMENS	HOURS OF	*
	WATTS	LINE WATTS	LUMEN CUTPUT	PER WATT	RATED LIFE	
****	**** MERCUR	Y VAPOR (DELUX	E WHITE)		and the second s	*
	1000	1075	63000	59	24000	*
	400	450	23000	56	24000	<u>.</u>
	250	290	13000	42	24000	~
	175	205	8500	49	24000	*
	100	120	4500	42	24000 16000	*
	75 50	93 61	3150 1680	37 31	16000	*
			198555549454575			*
****		HALIDE	155000	103	3000	*
	1500	1600 1100	155000 110000	100	12000	*
	1000 400	460	34000	85	15000	*
	175	210	14000	85	7500	*
****	*** HICH I	PRESSURE SODIUM		***************	***************************************	*
	1000	1080	140000	130	24000	*
•	400	480	50000	104	24000	· •
	250	310	27500	89	24000	1
	150	200	16000	80	24000	3
	100	135	9500	70	24000	
	70	85	5800	68	24000 24000	•
	(50)	$\begin{pmatrix} 70 \\ 42 \end{pmatrix}$	4000 2850	57 67	18000	-
	(35)	42	2030		10000	
****	****FLUORES	CENT	·			,
TRAIC	GHT 40	48	3150	66	20000+	1
IRCL		37	1830	50	12000+	1
IRCL		25 <u>23</u>	1050	42	12000+	
IRCL			850	• 37	12000+	
WIN '		16	900	56	10000+	
WIN '		12	600	50	10000+	
TRAI		11	400	36	7500+ 10000+	
WIN '		10	400	40	7500+	
TRAI		9	300 250	33 31 =	10000+	-
MTM.	TUBE 5	0 ==========	230			
****	**** INCAN	DESCENT 1000	23740	24.	1000	* +
· F	750	750	17040	23	1000	
F	500	500	10850	22	1000	•
·	200	200	3710	19	750	
ŀ	(150)	150	2880	19	750	
E	100	100	1750	18	750	
k	75	75	1190	16	750	
	**** QUART	S—IODINF.				
	1500	1500	35800	24	3000	
	1000	1000	23400	23	2000	
×						
*	500 250	500 250	10950 4850	22 19	2600 2000	

	Lighting		DAILY	MAN-			BARE	COST8		TOTAL	T
16	66 100   Lighting	CREV	OUTPUT	HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL O&P	
1600	90 watt	1 Ele	c .30	26.670	Ç	5,140	645		5,785	6,600	Ī
1650	135 watt		.20	40		6,905	970		7,875	9,025	
1700	180 watt		.20	40		7,308	970		8,278	9,475	١
1750	Quartz line, clear, 500 watt		1.10	7.270		1,872	175		2,047	2,325	J
1760	1500 watt		.20	40		3,427	970		4,397	5,200	I
1800	Incandescent, interior, A21, 100 watt		1.60	5		173	120		293	370	1
1900	A21, 150 watt		1.60	5		(211)	(120)		331	410	ı
2000	A23, 200 watt		1.60	5		227	120		347	430	
2200	PS 30, 300 watt		1.60	5		330	120		450	540	ł
2210	PS 35, 500 watt		1.60	5		576	120		696	810	1
2230	PS 52, 1000 watt		1.30	6.150		1,525	150		1,675	1,900	I
2240	PS 52, 1500 watt	1	1.30	6.150		2,382	150		2,532	2,850	١
2300	R30, 75 watt		1.30	6,150		375	150		525	630	1
2400	R40, 150 watt		1.30	6.150		408	150		558	670	
2500	Exterior, PAR 38, 75 watt		1.30	6.150		566	150		716	840	1
2600	PAR 38, 150 watt		1.30	6,150		525	150		675	795	١
2700	PAR 46, 200 watt		1.10	7.270		1,928	175		2,103	2,375	1
2800	PAR 56, 300 watt		1.10	7.270		2,193	175		2,368	2,675	
3000	Guards, fluorescent lamp, 4' long		1	8		375	195	•	570	695	1
3200	8' long		.90	8.890	l l	535	215	0	750	905	١
0010	RESIDENTIAL FIXTURES	+-	1.00	5.000							1
0400	Fluorescent, interior, surface, circline, 32 watt & 40 watt	1 Ek	c 20	.400	Ea.	48	9.70		57.70	67	١
0500	2' x 2', two U 40 watt	1	8	1		66	24		90	110	1
0700	Shallow under cabinet, two 20 watt		16	.500		45	12.15		57.15	67	ı
0900	Wall mounted, 41, one 40 watt, with baffle	-1 +	10	.800		41	19.40		60.40		1
	Incandescent, exterior lantern, wall mounted, 60 watt	1	16	.500		36	12.15		48.15	57	1
100	Post light, 150W, with 7' post		4	2		104	49		153	185	1
2500	Lamp holder, weatherproof with 150W PAR		16	.500		16	12.15		28.15	35	١
	With reflector and guard	1	12	.667		31	16.15	<del></del>	47.15		1
2550	Interior pendent, globe with shade, 150 watt		20	.400		78	9.70	I	87.70	100	
2600		+-	20		+						٦
0010	TRACK LIGHTING	1 8	6.70	1.190	Ea.	33	29		62	79	
0080	Track, 1 circuit, 4' section  8' section  12' section	1 5	5.30	1.510	<u> </u>	48	37		85	105	٦
0100	8' section		4.40	1.820		81	44		125	155	
0200	Y	+	6.70	1.190		36	29		65	82	-
0300	3 circuits, 4' section		5.30	1.510		48	37		85	105	
0400	8' section 12' section Feed kit, surface mounting	++	4.40	1.820		88	44	<u> </u>	132	160	٦
0500	12' section	1 1	16	.500		12	12.15		24.15		
1000		1	_	.333		1.98			10.08		5
1100	End cover		24	.500		16	12.15	i	28.15	1	
1200	Feed kit, stern mounting, 1 circuit		16		+	16	12.15		28.15		_
1300	3 circuit		16	.500					12.60	1	0
2000	Electrical joiner for continuous runs, 1 circuit	$\dashv$	32	.250	1 +	6.55	_		18.15		-
2100	3 circuit		32	.250		12.10	1	1	59.15		
2200	Fixtures, spottight, 150 PAR		16	.500	1-	47	12.15		113.15		_
3000	Wall washer, 250 watt tungsten halogen		16	.500		101	12.15			1	
3100	Low voltage, 25 watt, 1 circuit		16	.500		102	12.15		114.15		_
3120	3 circuit	1	16	.500	1 +	109	12.15	4	121.15	140	

HunTen

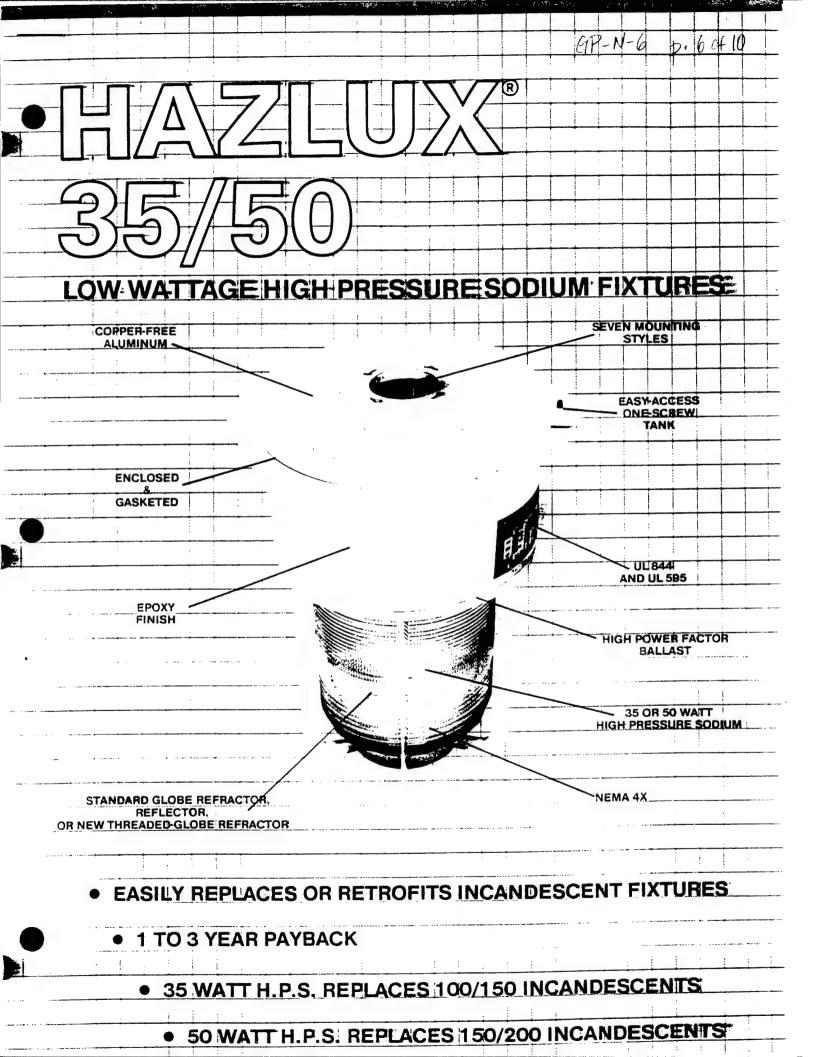
Distribution:

# GP-N-6 p.4 of 10. Telephone Call Confirmations

Project No. 290 0379 000
(218)
Local LD. 851-4577 Placed Rec'd Date 6-7-90
T. Todd. Conversed With Mr. Singer
Of American Scientific Lighting Co. Regarding HPS retrotits
For retrofits of incandescent fixtures, the "Bulb Lumenight"
and "Colorlight" products are recommended. The lamps are
replaceable in both and the "colorlight" is more whitish.  Contractors costs (including lamp) for quantities of 100+
Chatractors costs (including lamb ) for quentities of 100+
are as follows:
THE WAS TO HOW S.
Bulb Lumenight 35 W - \$45 / lamps only
Bulb Lumenight 35 W - \$45 (lamps only) 50 W - \$45 (\$16-\$20)
(also come in 70 W 100 W 150 W)
Colorlight 50W - \$67 (lamps only)
J. #30 )
they will send a copy of their rotalog for dimensions.
· · · · · · · · · · · · · · · · · · ·

	Lighting	-	DAILY	MAN-			BARE	COSTS		TOTAL	1
166	100 Lighting	CREV	OUTPUT	HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL OEP	1
5100	175 watt metal halide	1 Ele	c 8	1	Ea.	479	24		503	565	
5110	250 watt metal halide		8	1		500	24		524	585	l
5120	150 watt high pressure sodium		8	1		535	24		559	625	ı
5130	250 watt high pressure sodium		8	1		556	24		580	645	
5140	72"H 18" sq., 400 watt metal halide		8	1		525	24		549	615	1
5150	250 watt high pressure sodium		8	1		556	24		580	645	I
5160	400 watt high pressure sodium		8	1		581	24		605	675	1
	•	'	"	'	'		] -				ı
5190	Portable rectangle, 6" high 13.5" x 20"	1 Ele	c 12	.667	Ea.	293	16,15		309,15	345	1
5200	175 watt metal halide	1 60	12	.667	ı.	314	16.15		330.15	370	ı
5210	250 watt metal halide	+	12	.667	-	335	16.15		351.15	390	1
5220	150 watt high pressure sodium		1	.667		360	16.15		376.15	420	1
5230	250 watt high pressure sodium	++	12	- 12.2			_		381.15	425	┨
5240	8" high 18" x 24", 400 watt metal halide		12	.667		365	16.15			435	١
5250	250 watt high pressure sodium	+	12	.667		376	16.15		392.15		4
5260	400 watt high pressure sodium		12	.667		398	16.15		414.15	460	1
5270	Portable aquare, 15" high 13.5" sq., 175 watt metal halide	1	12	.667	<b>—</b>	324	16.15		340.15	380	4
5280	250 watt metal halide		12	.667		376	16.15		392.15	435	
5290	150 watt high pressure sodium	$\bot$	12	.667		360	16.15		376.15		4
5300	250 watt high pressure sodium		12	.667		386	16.15		402.15	450	
5400	Pendent 16" round/square, 175 watt metal halide	$\bot$	3.20	2.500		355	61		416	480	4
5410	250 watt metal halide		2.70	2.960		370	72		442	515	١
5420	400 watt metal halide		2.40	3.330		398	81		479	555	4
5430	150 watt high pressure sodium		3.20	2.500		398	61		459	525	ı
5440	250 watt high pressure sodium		2.70	2.960		428	72		500	575	
5450	400 watt high pressure sodium	1	2.40	3.330	+	454	81		535	620	
0010 EA	MP8	-					-		-		-
0010 LA 0080	Fluorescent, raipid start, cool white, 2' long, 20 watt	1 Ele	c 1	8	С	348	195		543	670	
0100	4' long, 40 watt	1	.90	8.890		198	215		413	535	٦
			.90	8.890		442	215		657	805	
0120	3' long, 30 watt	1	.80	10		874	245		1,119	1,325	٦
0150			.90	8.890		270	215		485	615	
0170	4' long, 35 watt energy saver	-	.90	8.890		618	215		833	995	٦
0200	Slimline, 4' long, 40 watt		.80			577	245		822	990	
0300	8' long, 75 watt	+		10		-			848	1,025	٦
0350	8' long, 60 watt energy saver		.80	10		603	245		965	1,150	
0400	High output, 4' long, 60 watt	+	.90	8.890		750	215		1,020	1,130	-
0500	8' long, 110 watt		.80	10	1	775	245		1,500	1,725	
0620	Very high output, 4' long, 110 watt	+	.90	8.890		1,285	215				-
0550	8' long, 215 watt		.70	11.430	4 1	1,285	275		1,560	1,825	
0600	Mercury vapor, mogul base, deluxe white, 100 watt	1	.30	26.670	_	2,142	645		2,787	3,300	_
0650	175 watt	$\perp$	.30	26.670		1,663	645		2,308	2,775	
0700	250 watt		.30	26.670		2,968	645		3,613	4,225	_
0600	400 watt		.30	26.670	1	2,340	645		2,985	3,525	
0900	1000 watt		.20	40		5,100	970		6,070	7,025	_
1000	Metal halide, mogul base, 175 watt		.30	26.670		3,749	645		4,394	5,075	
1100	250 watt		.30	26.670		4,712	645		5,357	6,125	
1200	400 watt		.30	26.670		4,386	645		5,031	5,775	
1300	1000 watt		.20	40		9,894	970		10,864	12,300	
1320	1000 watt, 125,000 initial lumens		.20	40		9,960	970		10,930	12,400	
1330	1500 watt		.20	40		9,268	970		10,238	11,600	
	Sodium high pressure, 70 watt	1	.30	26.670		4,712	645		5,357	6,125	
1350	100 watt		.30	26.670		4,871	645		5,516	6,300	
1200	150 watt	++	.30	26.670		5,059	645		5,704	6,525	
1360						5,380	645		6,025	6.875	
1370			30	1 2K K/M							
1370 1380	250 watt		.30	26.670		-				7,250	
1370 1380 1400	250 watt 400 watt	+	.30	26.670		5,727	645		6,372		
1370 1380	250 watt					-				7,250 16,100 5,300	

\* 1



GP-N-6 p.7 of 10

# HAZLUX35/50

### ENCLOSED & GASKETED

CLASSI, DIVISION 2

CLASS II, DIVISIONS 1 and 2 CLASS III

UL 844/UL 595 LISTED

# NOW, 35 WATT HIGH PRESSURE SODIUM FOR HAZARDOUS LOCATION APPLICATIONS

#### SUITABLE FOR MOST INDUSTRIAL APPLICATIONS...

The HAZIUX 35/50 is the first low wattage High Pressure Sodium fixture designed for hazardous location operations. It is UL 844 listed and is ideal for eye-level operations where fixtures are lower and closer to production such as corridors, production sites, and low overhead facilities like stairwells, catwalks, and tunnels.

#### RETURN ON INVESTMENT IN ONE TO THREE YEARS...

Depending on your application, the HAZLUX 35/50 fixture can pay for itself in one to three years. It uses less energy, provides more light, and dramatically reduces relamping maintenance in comparison to incandescent fixtures.

#### MORE LIGHT USING LESS ENERGY ...

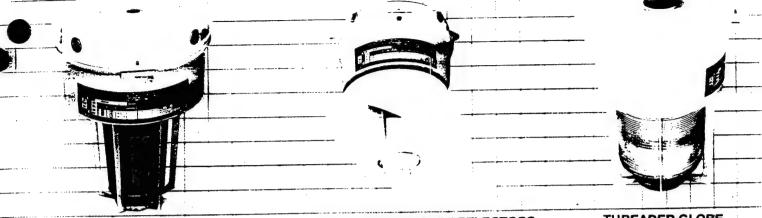
The HAZLUX 35/50 uses efficient High Pressure Sodium lamps which use less power to produce more light. A 35 Watt H.P.S. lamp provides 25% more lumens using less than half the power of a 100 Watt incandescent.

#### LESS RELAMPING SAVES LAMP COSTS & LABOR...

High Pressure Sodium lamps operate up to 24,000 hours; typical incandescent lamps last only 750 hours. Compare the HAZLUX 35/50 which requires relamping once or twice in five years to an incandescent fixture demanding more than 30 relampings in the same period.

# THE IDEAL RETROFIT FOR EXISTING INCANDESCENT FIXTURES...

The HAZLUX 35/50 easily fits on existing incandescent fittings through the use of HAZLUX Outlet box "V010" which fits standard "ordinary location" four inch outlet boxes. Retrofitting to mere economical and more efficient High Pressure Sodium 35 or 50 Watt lamps could not be easier.



GLOBE/GUARD TYPE

STANDARD OR ANGLE REFLECTORS

THREADED-GLOBE
"TR" REFRACTOR

# THE TYPICAL COST TO OPERATE ONE HAZLUX 35/50 IS \$20.05 ANNUALLY...COMPARED TO \$101.88 TO OPERATE AN INCANDESCENT FIXTURE FOR ONE YEAR.

#### COMPARE THE FACTS

- 1. H.P.S. lamps consume less energy but produce more lumens than incandescents.
- 2. H.P.S. lamps last more than 30 times longer than incandescents.

#### COST COMPARISON CHART

	HAZLUX 35W H.P.S.	HAZLUX 50W H.P.S.	INCANDESCE 100		INCANDESCE 15			ow
LUMENS	2200	40003	1750	1490	2880	2310		3410
ENERGY CONSUMED	43 W	60 W	100 W	100 W	150 W	150 W	200 W	200 W
ENERGY ① COST PER YEAR	\$9.42	\$13.14	\$21.90	<b>\$21.90</b> °	\$32.85	\$32.85	\$43.80	\$43.80
LAMP LIFE IN HOURS	16,000	24,000	750	2,500	750	2,500	750	2,500
LAMPS BOUGHT PER YEAR	.27	.18	5.8	1.75	5.8	1.75	5.8	1.75
COST OF LAMPS BOUGHT PER YEAR	\$8.21	\$5.47	\$2.92	\$1.75	\$5.84	\$3.50	\$11.68	\$7.00
LAMPING LABORA	\$ <b>2</b> \$164	\$ <del>1.44</del>	\$46:40	\$14.00	\$4 <b>67.462</b>	\$14:00	- 100	STA:00
ANNUAL COST	\$19.79	\$20.05	\$71.22	\$37.65	\$85.09	\$50.35	\$101.88	\$64.80

Determined at .05 KWH.

A) This lamp may soon be upgraded to 24,000 hours

<sup>2)</sup> Determined at \$8.00 per relamping

#### ATALOG NUMBERS & PRICING

(120 V.A.C. STANDARD)

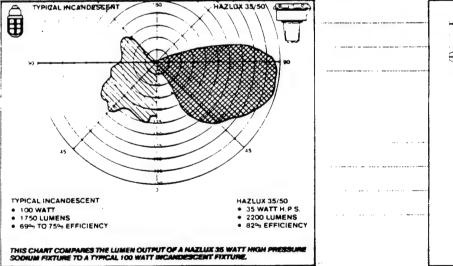
					, ; ;	
	PENDANT	CONE PENDANT	WALL	STANCHION	CEILING	OUTLET BOX
	35 WATT DS03P12-GG-P2	DS03P12-GG-A2	DS03P12-GG-B2	DS03P12-GG-S4	DS03P12-GG-C2	DS03P12-GG-010
VDARD OBE	\$207.00 50 WA DEN	\$238.00	\$226.00	\$226.00	\$210.00	\$210.00
STAI	DS05P12-GG-P2	D805R12-QG-A2-9	DS05P12-GG-B2V	DSOSPIS-OG-SCA	DS06PI2:GG-C2	DOM: LOCAL COMMENT
	5220.00	\$257,0000	\$239:000	23900 B	\$222,000	Head was a second
R". OBE	35 WATT DS03P12R-R5G-P2	DS03P12R-R5G-A2	DS03P12R-R5G-B2	DS03P12R-R5G-S4	DS03P12R-R5G-C2	DS03P12R-R5G-010
DED "T TOR GL	\$236.00 50 WATT	\$267.00	\$255.00	\$255.00	\$239.00	\$239.00
FRACT	DS05P12R-R5G-P2***	DSOSSESSION	DOCCO12NACC BOX	Decomposition	\$252.00	
BR	\$249.00	\$280.006	\$268.00	\$268.00	3232.00	

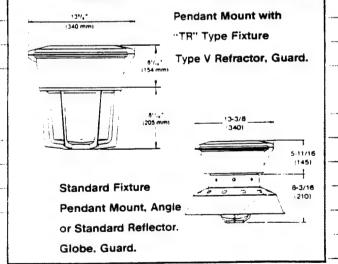
\*Catalog Numbers listed include Globe & Guard, 3/4" Conduit Opening; (1 1/4" Stanchion). "TR" Type V Refractor & Guard, 1" Conduit Openings and 1 1/2" Stancion Conduit Openings Available. Angle, Standard Dome Reflectors, I and-Types Land III Refractors Available: consult-Factory

For Flexible Pendant Substitute: "F2" for "P2" in Pendant Mount Catalog Number.

#### **POOTOMETRICS**

#### DIMENSIONS









The HAZLUX 3 enclosed & gasketed 35 to 1000 watts

The HAZLUX 5 explosion-proof 50-250 watts

8676 Pennelli Drive

	Lighting		DAILY	MAN-	-		BARE	50818		TOTAL	
160	6 100   Lighting	CREW	OUTPUT	HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL DAP	l
	Recessed, 200 watt	1 Elec	6.70	1.190	Ea.	51	29		80	99	ľ
030	Pendent, 200 watt		6.70	1.190		43	29		72	90	1
040	Wall, 200 watt		8	1		44	24		68	84	l
100	Fluorescent, surface mounted, 2 lamps, 41, RS, 40 watt		3.20	2.500		70	61		131	165	1
110	Industrial, 2 lamps 4' long in tandem, 430 MA		2.20	3.640		139	88		227	280	ı
130	2 lamps 4' long, 800 MA		1.90	4.210		100	100		200	260	1
160	Pendent, indust, 2 lamps 41. in tandem, 430 MA		1.90	4.210		149	100		249	315	l
170	2 lamps 4' long, 430 MA		2.30	3.480		80	84		164	210	1
180	2 lamps 4' long, 800 MA		1.70	4.710		109	115		224	290	١
200	Mercury vapor with ballast, 175 watt		3.20	2.500		226	61		287	340	1
300	Explosionproof										ı
310	Metal halide, ballast, ceiling, surface mounted, 175 watt	1 Elec	2.90 .	2.760	Ea.	668	67		735	835	1
320	250 watt		2.70	2.960		775	72		847	960	ı
330	400 watt		2.40	3.330		836	81		917	1,050	1
340	Ceiling, pendent mounted, 175 watt		2.60	3.060		640	75		715	815	1
3350	250 watt		2.40	3.330		745	81		826	940	1
3360	400 watt		2.10	3.810		816	92		908	1,025	1
5370	Wall, surface mounted, 175 watt		2.90	2.760		698	67		765	865	
5380	250 watt		2.70	2.960		805	72		877	990	1
5390	400 watt		2.40	3.330		856	81		937	1,050	
5400	High pressure sodium, ceiling surface mounted, 70 watt		3	2.670		724	65		789	890	ı
5410	100 watt		3	2.670		738	65		803	905	
5420	150 watt		2.70	2.960		765	72		837	945	
5430	Pendent mounted, 70 watt		2.70	2.960		678	72		750	850	
5440	100 watt		2.70	2.960		698	72		770	875	
5450	150 watt		2.40	3.330		724	81		805	915	
	Wall mounted, 70 watt		3	2.670		750	65		815	920	1
6470	100 watt		3	2.670		775	65	ļ	840	945	
6480	150 watt		2.70	2.960		780	72		852	965	7
5510	Incandescent, ceiling mounted, 200 watt		4	2		250	49		299	345	
5520	Pendent mounted, 200 watt		3.50	2.290		219	55		274	320	7
6530	Wall mounted, 200 watt		4	2		270	49		319	370	
6600	Fluorescent, RS, 4' long, ceiling mounted, two 40 watt		2.70	2.960		1,310	72		1,382	1,550	7
5610	Three 40 watt		2.20	3.640		1,915	88		2,003	2,225	
6620	Four 40 watt		1.90	4.210		2,490	100		2,590	2,900	
6630	Pendent mounted, two 40 watt		2.30	3.480		1,390	84		1,474	1,650	
6640	Three 40 watt		1.90	4.210		2,020	100		2,120	2,375	
6650	Four 40 watt		1.70	4.710		2,570	115		2.685	3,000	
5700	Mercury vapor with ballast, surface mounted, 175 watt		2.70	2.960		545	72		617	705	٦
	250 watt		2.70	2.960		586	72		658	750	
5710	400 watt		2.40	3.330		714	81		795	905	1
5740	Pendent mounted, 175 watt		2.40	3.330		550	81		631	725	
5750	250 watt		2.40	3.330		561	81		642	735	1
5760	400 watt		2.10	3.810		683	92		775	885	
5770	Wall mounted, 175 watt		2.70	2.960		576	72		648	740	1
5780	250 watt		2.70	2.960		632	72		704	800	
5790	400 watt		2.40	3.330		750	81		831	945	1
6820	Vandalproof, surface mounted, fluorescent, two 40 watt		3.20	2.500		105	61		166	205	
5850	Incandescent, one 150 watt	1	8	1		45	24		69	85	1
5860	Mirror light, fluorescent, RS, acrylic enclosure, two 40 watt		8	1		61	24	1	85	105	
5900	One 40 watt		8	1		56	24		80	97	
5910	One 20 watt		12	.667		49	16.15		65.15	78	
5920	Low bay, aluminum reflector, 70 watt, high pressure sodium		4	2		298	49		347	400	
	250 watt, high pressure sodium		3.20	2.500		535	61		596	680	
7010	400 watt, high pressure sodium		2.50	3.200		561	78		639	730	
7020	8altast replacement, by weight of baltast, to 15' high	'	2.50	3.500	'						
7500		1 Elec	10	.800	Ea.		19.40		19.40	29	
7520	Indoor fluorescent, less than 2 lbs. 2 40W, watt reducer, 2 to 5 lbs.	1	9.40	.851	1.	17	21		38	49	

REYNOLDS.	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS · PL	ANNERS
11	CORPORAT	ED	

SUBJECT RAAP	Ballast	Project
Screening	Calc.	0
ナン	TOAD	

AEP NO 290 0379 000

Replace existing ballasts with energy efficient ballasts in fluorescent 4' fixtures

-Assume lamps will be retrofited with ballasts for compatibility & acceptable light output.

- Calculations show energy savings and costs for bailasts only.

- Assume standard Z-lamp industrial ballast is replaced with watt-miser Z-lamp ballast.

Energy savings = [96-2(40)]-[71-2(34)]W = 13 W/fixture

= 13 W x 24 hr , 365 days = 114 kuch max.

Cost savings =  $114 \text{ kwh} \times \frac{50.03026}{\text{kwh}} = \frac{3.45}{\text{yr}}$ 

Lost for mat'l only = \$21.94 (1987 vender jucie)

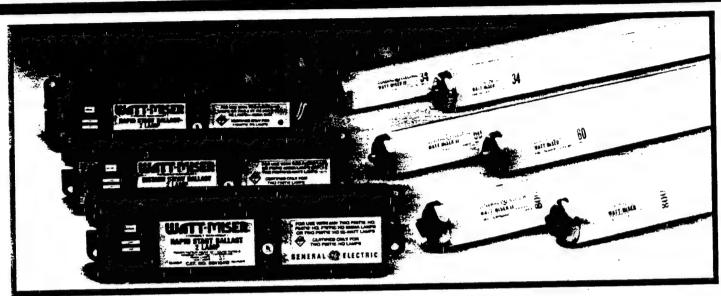
assuming 5% inflation to 1990\$, material cost = \$23.04 Cost for labor = \$21 (1989 Means Electrical) Construction cost =  $[$23.04 + ($21 \times 0.683)] \times 1.507 = $56.34$ 

16.3 yr > 10 yr 

this project is not recommended due to high particies ven when continuous operation is assumed.

(see combination ballast/relamping project)

#### GE WATT-MISER" BALLASTS USE LESS WATTS PER FIXTURE TO DELIVER HIGH ENERGY SAVINGS



#### Watt-Miser Ballasts

- Compatible with standard or energy-saving lamps (3-lamp WM ballast compatible only with ES lamps)
- Cooler operation extends ballast life
- Dimensionally interchangeable with standard ballasts.
- CBM-certified by ETL with standard lamps. (3-lamp WM ballast not CBM certified)
- · UL-listed, Class P.

The GE Watt-Miser ballast is inherently more energyefficient than a standard ballast. Even greater savings come from pairing Watt-Miser ballasts with today's popular reduced-wattage lamps. Watt-Miser ballasts are offered for 4' Rapid Start; 8' Instant Start; and 8' High Output applications. A 3-lamp Watt-Miser ballast in a standard rapid start case is available for use with four-foot energysaving lamps. The chart shows fixture watts and energy \$ that can be saved by replacing standard lamps and ballasts with Watt-Miser ballasts and energy-saving lamps.

#### Lamp/Ballast System Replacement Chart

	Standard Sy	stem <sup>(1)</sup>		Watt-Miser System		
Fluorescent Fixture Type	Lamp Type	Watts Per Fixture	Lamp Type <sup>(2)</sup>	Watt- Miser Ballast <sup>(4)</sup>	Watts Saved Per Fixture	Energy <sup>(3)</sup> \$ Saved Per Fixture
4-LAMP TROFFER	F40 F40 (34W)	181 159	F40LW/RS/WMII F40LW/RS/WMII	(2)8G1024W (2)8G1024W	41 19	\$ 9.84 \$ 4.56
3-LAMP TROFFER	F40	149	F40LW/RS/WMII	(1)8G1024W and (1)8G1074W (1)8G1324W	40 43	\$ 9.60 \$10.32
2-LAMP INDUSTRIAL	F40 F96T12 F96T12/HO	96 172 255	F40LW/RS/WMII F96T12/LW/WMII F96T12/LW/HO/WMII	8G1024W 8G1004W 8G1154W	25 46 56	\$ 6.00 \$16.56 \$20.16
2-LAMP, SURFACE- MOUNT, WRAP AROUND	F40	82	F40LW/RS/WMII	8G1024W	16	\$ 3.36
4-LAMP, SURFACE- MOUNT, WRAP AROUND	F40	165	F40LW/RS/WMII	(2)8G1024W	32	\$ 6.72



<sup>(2)</sup> Other energy-saving lamps may be used to obtain similar savings.

<sup>(3)</sup> Annual energy savings at 8° KWH; 3000 Hrs. - F40; 4500 Hrs. - F96.

<sup>(4)</sup> Ballast codes shown are 120-volt. For complete application information, see product tables.

# Telephone Gall

#### Project Not 87-210-00

PTAC No. 865911

# feynolds; smith and hills

Local 396-7446	LD: 980-735)	Placed	Rec'd_	Date	5-27-87
	sters			- Jefson /	
OF-G. E. Lamp N	larketing / Enginee	ving Rê	garding balla	sts	
described above the control of bringing a sec	marinam (nobel) () (general) e emerciare mindre d	A B 1497年(2.66年刊376年6月)	er and the second section of the second section of the second section of the second section se	SCALATINA AND AND AND AND AND AND AND AND AND A	
Stan Jefson	provided costs	JO	e Howley pro	ovided water	iges light
	etimes -		_	3	0 0
4 ft			Cost	Life (fun	ction of heat)
Standard	8G 10ZZWF	(5)	\$ 15.86	10-12 yr	
Wattmiser	8G 1024 WF	(W)	(121.94)	24 yr	
MaxinuserII	89 10 28 WF	(M)	\$ 72.89	24 yr	energy- efficient
optimiser	M28-120F	(0)	\$ 34.10	30 yr	
- Maximis	er II - patent	ed, fr	Il light out	put using en	ergy Saving
	lampo	, may	be able to dela	up with the	one
- Optimise	- patented	, newe	st, lowest	wattage int	nt
				<u> </u>	
8ft					
Standard	861011WF	(5)	\$ 25.90	12 yr	
Wathurser	861004 WF	(w)	\$ 36.86	24 yr	
Maximiser I	I 861008WF	(m)	\$39.17	24 W	
Distribution:					

GP-N-7 p. 4 of A

	Lighting		DAILY	MAN-			BARE			TOTAL
166	6 100   Lighting	CREW	OUTPUT	HOURS	TINU	MAT.	LABOR	EQUIP.	TOTAL	INCL O&P
020	Recessed, 200 watt	1 Elec	6.70	1.190	Ea.	51	29		80	99
030	Pendent, 200 watt		6.70	1.190		43	29		72	90_
040	Wall, 200 watt		8	1		44	24		68	84
100	Fluorescent, surface mounted, 2 lamps, 41, RS, 40 watt		3.20	2.500		70	61		131	165
110	Industrial, 2 lamps 4' long in tandem, 430 MA		2.20	3.640		139	88		227	280
130	2 lamps 4' long, 800 MA		1.90	4.210		100	100		200	260
160	Pendent, indust, 2 lamps 41. in tandem, 430 MA		1.90	4.210		149	100		249	315
	2 larmos 4' long, 430 MA		2.30	3,480		80	84		164	210
170	2 lamps 4' long, 800 MA		1.70	4.710		109	115		224	290
180			3.20	2.500	1 1	226	61		287	340
200	Mercury vapor with ballast, 175 watt	+-	0.20	2.555						
300	Explosionproof	1 Elec	2.90	2.760	Ea.	668	67		735	835
310	Metal halide, ballast, ceiling, surface mounted, 175 watt	LEGU	2.70	2.960		775	72		847	960
320	250 watt		2.40	3.330		836	81		917	1,050
330	400 watt	-		3.080		640	75		715	815
340	Ceiling, pendent mounted, 175 watt	1	2.60			745	81		826	940
350	250 watt		2.40	3.330	$\vdash$		92		908	1,025
360	400 watt		2.10	3.810		816	1		765	865
370	Wall, surface mounted, 175 watt	++	2.90	2.760	<del>                                     </del>	698	67		877	990
380	250 watt		2.70	2.960	1	805	72			1.050
390	400 watt	1	2.40	3.330		856	81		937	
400	High pressure sodium, calling surface mounted, 70 watt		3	2.670	1	724	65		789	890 905
410	100 watt	+	3	2.670		738	65		803	945
420	150 watt		2.70	2.960		765	72		837	
430	Pendent mounted, 70 watt	1	2.70	2.960		678	72		750	850
440	100 watt	1	2.70	2.960	1	698	72		770	875
450	150 watt	$\bot \bot$	2.40	3.330		724	81		805	915
460	Wall mounted, 70 watt		3	2.670	1	750	65		815	920
470	100 watt		3	2.670		775	65		840	945
480	150 watt		2.70	2.960		780	72		852	965
510	Incandescent, ceiling mounted, 200 watt		4	2		250	49		299	345
520	Pendent mounted, 200 watt		3.50	2.290		219	55		274	320
5530	Wall mounted, 200 watt		4	2		270	49		319	370
600	Auorescent, RS, 4' long, ceiling mounted, two 40 watt		2.70	2.960		1,310	72	1	1,382	1,550
610	Three 40 watt		2.20	3.640		1,915	88		2,003	2,225
620	Four 40 watt		1.90	4.210		2,490	100		2,590	2,900
630	Pendent mounted, two 40 watt	1L	2.30	3.480		1,390	84		1,474	1,650
640	Three 40 watt		1.90	4.210		2,020	100	1	2,120	2,375
650	Four 40 watt		1.70	4.710		2.570	115		2,685	3,000
700	Mercury vapor with ballast, surface mounted, 175 watt		2.70	2.960		545	72		617	705
710	250 watt		2.70	2.960		586	72		658	750
740	400 witt		2.40	3.330		714	81		795	905
750	Pendent mounted, 175 watt		2.40	3.330		550	81		631	725
760	250 watt		2.40	3.330		561	81		642	735
770	400 watt		2.10	3.810		683	92		775	885
780	Wall mounted, 175 watt		2.70	2.960		576	72		648	740
790	250 watt		2.70	2.960		632	72	<u></u>	704	800
820	400 watt		2.40	3.330	_	750	81		831	945
	Vandalproof, surface mounted, fluorescent, two 40 watt		3.20	2.500		105	61		166	205
850	Incandescent, one 150 watt		8	1		45	24		69	85
860	Mirror light, fluorescent, RS, acrylic enclosure, two 40 watt		8	1		61	24		85	105
900		1	8	1		56	24		80	97
910	One 40 watt		12	.667		49	16.15	5	65.15	78
920	One 20 watt  Low bay, aluminum reflector. 70 watt, high pressure sodium	+	4	2	T	298	49		347	400
7000			3.20	2.500		535	61		596	680.
7010	250 watt, high pressure sodium	1	2.50		_	561	78		639	730
7020	400 watt, high pressure sodium	'	2.30	J.200	1	1	1			
7500	Ballast replacement, by weight of ballast, to 15' high	1 Ele	c 10	.800	Ea.	+	19.4	0	19.40	29
7520	indoor fluorescent, less than 2 lbs.	1 518	9.40		<b>La</b> .	17	21	V	38	49

	SUBJECT	AAP Lighting Tre	PLECTS AEP NO. 7	190 0379 000
REYNOLDS, SMITH AN			SHEET	/ of 10
ARCHITECTS . ENGINEERS .	PLANNERS DESIGNER	T. Todd	DATE	
INCORPORATED	CHECKER	,	DATE	
GP-N-8 RE	PLACE INCANDE	SCENTS WITH	OLOR-CORREC	TED HPS
SC	REW-INS FOR	EXPLOSION PROOF	= FIXTURES	
Calculationes u	seve made on a	per-unit basis +	for installing	50 W
	reded units with			
includesant	firstures. the pe	r-unt calculati	ous are ou	ogo Z.
Only areas operation the built	fixfures. the pe ating 3 shifts / day dung survey data	, a list of the	buldings wi	the potantial
	lighting projects			
assumed for	This ECO that	= 90% of the	interior fix	tures are
11	and can be justice			act dimensions
	i seven-un ret		be verified.	
	es = 0.9 (1536)		0 .	
Energy Saw	ings = 499 Kurh x	0.003413 MEtu,	, 1382 fixtures	= 2354 M Gtu
Energy cost s	w. fixtur	+ 1382 = \$20 e	0,882/yv	
Hall & Labor	Cost swings = +	7.39 1382 = 94.64.	\$10,213/4	
Total cost	Savings = 20,88	2 + 10,213 =	131,095 19	·
Project cos	t = \$118.65 x	1382 = \$ 163	3,974	
(Lous	truction cost = \$	163,974/1.115	= \$147,062	)
	back = 1163,9 \$31,099	,		

EYNOLDS. SMITH AND HILLS RCHITECTS • ENGINEERS • PLANNERS INCORPORATED	SUBJECT RAAP LIS SCHEEMING DESIGNER 7	ghting Projects Calcs. Todd	AEP NO 290 03 SHEET 2 OF DATE DATE	79000
GP-N-8 Replace intendent	fits for uple	incondescents	with 50 W :	HP5
- Assume color ren 50 w HPS (color excled requireme	dition is impo corrected) is	Hard in this chosen even the	area, so -	the us
Energy Savings = (158		•		2
Energy cost savings =	499 kmh x	\$0.03026 -	# 15.11 yr	is a shirt was a second
Labor & Motlesst sa				
=[(\$2.11 mate + \$1.20 lo	(bor ×0.683 ×1.2)		.45 labor × 0.66	
Total cost savings	= \$ 15.11 +	7.39 = \$ 22.	.50 V	
Mat'l cost = \$ 67.00	for fixture w/	lamp	(1990 Neuso	or into.)

Labor cost = \$1.20 × 1.70 Html+×1. 2 exp. pron × 0.683 = \$1.18 Project  $Cost = [(1.045 \times $67.00) + (1.2 \times $1.18)] \times 1.661 = $118.65$ Simple payback =  $\frac{$118.65}{$22.50/yr} = 5.3 yr < 10 yr$ 

Note: HPS lamps are replaceable in the retrofit ballasts.

Radford Army Ammunition Plant List of Buildings with Incandescent Lighting

Blda No	Name/Process	Location	Similar	Fixtures/Bldg.	Total Fixtures
		NO 480 Line		17	17
1000 -00	Cotton Linter Warehouse	NC, A&B-LINE	10	20	200
1606 -00	Open Tank Air Dry	Sol. Recovery, A-Line			324
1611 -00	Solvent Recovery House	Sol. Recovery, B-Line	2/	20	60
3513 -00	C-1 Press & Cutting House SG Curing Hse Carpet Rolls	Green, U-Line	10	5	50
4912 -27	SG Curing Hse Carpet Rolls	Cast Prop. (Rucket)	10	6	6
4924 -06	Machine and Saw House	Cast Prop. (Rocket)	7	. 8	56
7106 -04	Dry House #4 (Cure Grain)	IST R P		4	4
9334 -15	Blender House	4th Rolled Powder	1	4	•
TOTAL FOR	EXTERIOR FIXTURES				717
420 -02	Acid Waste Disposal (C-Line)	Waste Acid	1	8	8
2019 -00	Boiling Tub House	NC. B-Line	3	50	150
2022 -00	Beater House	NC, B-Line	3 3	40	120
2024 -00	Poacher & Blending House		3	30	90
3513 -00	C-1 Press & Cutting House	Green. C-Line	3	50	150
4912 -40	Forced Air Dry House	Pilot B	21	10	210
4912 -11	LG Mold Loading House	Cast Prop. (Rocket)	2	6	12
4912 -03	MK 43 Sawing and Inhibiting	Cast Prop. (Rocket)		4	4
4915 -00	Small Grain Mold Assembly	Cast Prop. (Rocket)	1	7	7
4921 -00	Inspect/Clean NG Tanks *	Cast Prop. (Rocket)	1	21	21
4951 -02	TOW Launch Saw House	Pilot B	1	8	8
5008 -01	15 Inch Press House	Pilot A	3	2	6
4304 -00	Paste Blending House	1st R P	1	20	20
7113 -00	Roll House (Rolled Powder)	1st R P (F-Line)	1	130	130
9310 -02	Rolled Powder Building	4th Rolled Powder	2	300	600
TOTAL FOR	INTERIOR FIXTURES				1536

CONSTRUCTION COST	ESTIMA	ΓE		DATE PREPARED 6/90		SHEET	4 of 10
					BASIS FOR ESTIMATE		
RADFORD ARMY AMMUNITION PLANT					_ °	CODE A (No deel	design)
ARCHITECT ENGINEER						] CODE C (Final d THER (Specify)	eergn)
DRAWING NO.	J HILLS	ESTIM	ATOR			CHECKED BY	
GP-N-8	QUANT	_	T. Too	LABOR		MATERIAL	
Incand to 50 W HP3 SUMMARY	NO. UNITS	UNIT	PER	TOTAL	PER	TOTAL	COST
Replace incandescent	1382	fixt.	1.18	1631	67.00	92594	94225
lamps with 50 W HPS							
screw-in retrofits							
	1 11					411	7 4.7
Sales Tax	4.5%			7.0/		416	
FICA Insurance	20.07.	,		326		0/7/	326
Subtotal	1, 0/			1957		9676	
Overhead	15.0%						14808
Profit	10.0%						11353
Performance Bond	1.0%		-				1249
Hercufes Support	6.07						7568
Contingency (ost	10.0%						13370
Construction Cost							177000
						-	
			-				İ
	***						

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ECP ENERGY CONSERVATION PRODUCTS, 511 CANAL STREET, NYC, NY, 10013—TEL (212)-925-5991

### POWER CONSUMPTION AND LUMEN CUTPUT DATA

					93222
* * WATTS	LINE WATTS	TOTAL LUMEN OUTPUT	lumens Per walt	HOURS OF RATED LIFE	*
******* MERCIR	Y VAPOR (DELUX	E WHITE)			*
* 1000	1075	63000	59	24000	*
* 400	450	23000	56	24000	<del></del>
* 250	290	13000	42	24000	*
<b>*</b> 175	205	<b>8500</b>	49	24000	
* 100	120	4500	42	24000	
* 75	93	3150	37	16000	*
* 50	61	1680	31	16000	
****** METAL	HALIDE				*
* 1500	1600	155000	103	3000	*
* 1000	1100	110000	100	12000	<del>*</del> _
* 400	460	34000	85	15000	*
* 175	210	14000	85	7500 	*
****** HTGH F	RESSURE SODIUM				*
* 1000	1080	140000	130	24000	*
* 400	480	50000	104	24000	<del></del>
* 250	310	27500	89	24000	*
* 150	200	16000	80	24000	
* 100_	135	9500	70	24000	*
* 70	<del>25</del> <del>70</del>	5800	68 57	24000 24000	*
* 70 50 * 35	(42)	4000 2850	67	18000	*
=======================================					*
********FWORES	CENT				*
STRAIGHT 40	48	3150	66	20000+	*
CIRCLINE 32	37	1830	50	12000+	
CIRCLINE 22	25_	1050	42	12000+	
CIRCLINE 20	23	850	37	12000+	*
TWIN TUBE 13	16	900	56 50	10000+ 10000+	*
TWIN TUBE 9	12	600 400	50 36	7500+	*
STRAIGHT 8 TWIN TUBE 7	10	400	40	10000+	*
STRAIGHT 6	9	300	33	7500+	*
TWIN TUBE 5		250	31 =	10000+	* **
	DECEMENT				*
****** INCANI	DESCENT 1000	23740	24	1000	* ***
* 750		17040	23	1000	*
* 500	/ 50				
	750 500			1000	*
	500	10850		7 <u>50</u>	
* 200		10850 3710	22	750 750	* *
	500 200	10850		750 750 750	* *
200 200	500 200 150	10850 3710 2880	22 19 19	750 750	* * *
200 150 100 75	500 200 150 100 75	10850 2710 2880 1750	22 19 19 18	750 750 750	*
200 150 100 75	500 200 150 100 75 S—IODINF.	10850 3710 2880 1750 1190	22 19 19 18 16	750 750 750	* * * * * * * * * * * * * * * * * * * *
200 150 100 75 QUARTS	500 200 150 100 75	10850 2710 2880 1750	22 19 19 18 16	750 750 750 750 750 2000	* * * * * * * * *
200 150 100 75	500 200 150 100 75 S—IODINF.	10850 2710 2880 1750 1190	22 19 19 18 16	750 750 750 750	* * * * * * * * * *

WATTAGE APPY

STEMORIES.

12

AVERAGE

24.000

LAMP	WATTAGE	APPX LUMENS	AVERAGE LIFE HRS.	STANDARD CASE CITY.
------	---------	----------------	----------------------	------------------------



### RAPID START FLUORESCENT U LAMPS

FB40/16/CW 40 2,950 12,000 12	FB40/U6/CW/EW FB40/U6/CW	34 40	2,600 2,950	12,000 12,000	12
-------------------------------	-----------------------------	----------	----------------	------------------	----



### INSTANT START SLIMLINE FLUORESCENT LAMPS

F72T12/CW 55	4,550	12,000	12
F96T12/CW/EW 60	5,600	15,000	15
F96T12/CW 75	6,200	12,000	15



### HIGH & VERY HIGH OUTPUT FLUORESCENT LAMPS

	F96T12/CW/H0/EW F96T12/CW/H0 F96T12/CW/VH0/EW	110 185	8.300 9,200 14,000	12,000 12,000 12,000	15 15 15
1	F96T12/CW/VH0	215	15.500	12,000	15



### METAL HALIDE UNIVERSAL BURN MEDIUM BASE LAMPS

MH35/U	35	2,300	5,000	12
MH50/U	50	3,400	5.000	12
MH70/U	70	5.500	5.000	12
MH100/U	100	7,200	7,500	12
MH150/U	150	12,000	10.000	12



### METAL HALIDE UNIVERSAL BURN MOGAL BASE LAMPS

MH175/U	175	14.000	10.000	12
	175	14.000	10.000	12
MH175/C/U			10,000	12
MH250/U	250	20.500		12
MH250/C/U	250	20.500	10.000	1 -
MH400/U	400	36,000	20.000	6
MH400/C/U	400	36,000	20.000	6
MH1000/U	1000	110,000	12.000	6
MH1000/C/U	1000	105.000	12.000	1 6



### COMPACT DOUBLE ENDED HQI METAL HALIDE LAMPS

HQI 70	70	5.000	10.000	12
HQI 150	150	11,000	10.000	12
HQI 250	250	19.000	10.000	12
HQI 400	400	25.000	10.000	12



HIGH PRESSURE	SODIOM	MEDIOM P	ASE LAMPS	
LU35.MED	35	2.250	(16.000)	12
LU35/D/MED	35	2.150	16.000	12
LU50/MED	50	4.000	24.000	12
LU50/D/MED	50	3.800	24.000	12
LU70/MED	70	6.300	24.000	12
LU70/D/MED	70	5.985	24.000	12
LU100/MED	100	9.500	24.000	12
LU100/D/MED	100	8.800	24.000	12
111150/MED	150	16,000	24.000	12



### COLOR IMPORTED HICH PRESCRIPE CORRES I AMP

150

L	ULUK IMPNU	VED HIGH P	1ESSUNE SU	DILLE DAM	
-	NHT50SDX	50	2.500	12.000	12
-					

15.000

24.000

12



### HIGH PRESSURE SODIUM ED-231/2 MOGUL BASE LAMPS

LU <b>50</b>	50	4.000	24.000	12
LU50/D	50	3.800	24.000	12
LU70	1 70	6,300	24.000	12
בי.פקעב	1 70	5.985	24,000	12
LU100	100	9.500	24.000	12
LU100/D	100	8.800	24.000	12
LU150/55	150	16.000	24.000	12
LU150/55/D	150	15.000	24.000	12



CAMP	1911 1941	LUMENS	LIFE HRS.	CASE CITY.
HIGH PRESSUI	RE SODIUM	E-18 MOGU	L BASE LA	MPS
LU200	200	22,000	24,000	12
LU250	250	29.000	24,000	12
LU250/D	250	26.000	24,000	12
LU310	310	37.000	24.000	12
250.0			04.000	140

50,000



### LOW PRESSURE SODIUM LAMPS

LU400



### MOSE LOW VOLTAGE 12V THINGSTEN HALOGEN LAMPS

WK IS TOM ACT	TWOE IEA II	GHOOT EN TH	UPDATE IN	11111	_
ESX (N)	20	3,300	2.000	20	
BAB (W)	20	460	2.000	20	
EYR (N)	42	7,300	2,000	20	
EYS (M)	42	2,500	2.000	20	
EYP (W)	42	1,200	2.000	20	
EXT (N)	50	9.150	3.000	20	
EXZ (M)	50	3.000	3,000	20	
EXN (W)	50	1,500	3,000	20	
EYF (N)	75	11.500	3.500	20	
EYJ (M)	75	4.500	3.500	20	
EVC (W)	75	2.000	3,500	20	



## MR16 LINE VOLTAGE 120V MEDIUM BASE TUNGSTEN HALOGEN LAMPS

M/JDR75W/N	75	6.300	2.000	12
M/JDR75W/M	75	3.500	2.000	12
M/JDR75W/W	75	2.100	2.000	12
M/JDR100/N	100	8.500	2.000	12
M/JDR100/M	100	4 500	2.000	12
M/JDR100/W	100	3.000	2.000	12



### MR16 LINE VOLTAGE 120V INTERMEDIATE BASE

IUNGSIEN HALL	JOEN LAM	ro		
I/JDR75W/N	+ 75	6.300	2.000	12
I/JDR75W/M	75	3.500	2,000	12
I/JDR75W/W	75	2.100	2.000	12
1/JDR100/N	100	8.500	2.000	12
/JDR100/M	100	4 500	2.000	12
/JDR100/W	100	3.000	2.000	12



## TUNGSTEN HALOGEN LINE VOLTAGE MEDIUM BASE TUBULAR LAMPS

I OBOLAN LAM	70			
64484/CL	75	1,200	2.000	15
64484/FR	75	1.140	2.000	15
64486/CL	100	1.600	2.000	15
64486/FR	100	1 520	2.000	15
64488/CL	150	2.760	2.000	15
64488/FR	150	2.622	2.000	15



## TUNGSTEN HALOGEN LINE VOLTAGE DOUBLE ENDED LAMPS

DOGGE FILES				
Q100T3/CL Q150T3/CL Q200T3/CL Q300T3/CL Q500T3/CL	100 150 200 300 500	1.600 2.800 3.600 6.000 11.000 33.000	200 200 200 200 200 200 200	12 12 12 12 12 12 12
Q1500T3/CL	1500	33.000	200	12



LU150/MED

LU150/D/MED

BROOKLYN, NEW YORK

TEL. (800) 552-3465

(718) 851-4577 ·

FAX (718) 853-2390

i de production of nichologic

	Lighting			DAILY	MAN-			BARE	COSTS		TOTAL	Γ
	66 100 Lighting	CF	REW	OUTPUT	HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL C&P	
1600	90 watt	1	Elec	.30	26.670	Ç	5,140	645		5,785	6,600	14
1650	135 watt			.20	40		6,905	970		7,875	9.025	1
1700	180 watt			.20	40		7,308	970		8,278	9,475	l
1750	Quartz line, clear, 500 watt			1.10	7:270		1,872	175		2.047	2,325	1
1760	1500 watt		Т	.20	40		3.427	970		4,397	5,200	ı
1800	incandescent, interior, A21, 100 watt			1.60	5		173	120		293	370	1
1900	A21, 150 watt			1.60	5		(211)	(20)		331	410	l
2000	A23, 200 watt			1.60	5		227	120		347	430	1
2200	PS 30, 300 watt			1.60	5		330	120		450	540	l
2210	PS 35, 500 watt ( )			1.60	5		576	120		696	810	1
2230	PS 52, 1000 watt			1.30	6.150		1,525	150		1,675	1,900	۱
2240	PS 52. 1500 watt			1.30	6.150		2.382	150		2,532	2,850	1
2300	R30, 75 watt			1.30	6.150		375	150		525	630	1
2400	R40, 150 watt			1.30	6.150	$oxed{oxed}$	408	150		558	670	1
2500	Exterior, PAR 38, 75 watt			1.30	6.150		566	150		716	840	1
2600	PAR 38, 150 watt		$\perp$	1.30	6.150	$\vdash \vdash$	525	150		675	795	1
2700.	PAR 46, 200 watt			1.10	7.270		1,928	175		2,103	2,375	١
2800	PAR 56, 300 watt			1.10	7.270	igsqcut	2,193	175		2,368	2.675	4
3000	Guards, fluorescent lamp, 4' long			1	8		375	195		570	695	Į
3200	8' long		<u> </u>	.90	8.890	1	535	215		750	905	4
0010	RESIDENTIAL FIXTURES										_	ı
0400	Fluorescent, interior, surface, circline, 32 watt & 40 watt	1	Elec	-	.400	Ea.	48	9.70		57.70	57	4
0500	2' x 2', two U 40 watt			8	1		66	24		90 57.15	110	
0700	Shallow under cabinet, two 20 watt		1	16	.500	-	45	12.15		60.40		$\overline{}$
200	Wall mounted, 41, one 40 watt, with baffle	- 1		10	.800		41	19.40		48.15	1	1
0	Incandescent, exterior lantern, wall mounted, 60 watt		+	16	.500	-	36	12.15		153	185	-
2100	Post light, 150W, with 7' post	ł		4	2		104	49 12.15		28.15		1
2500	Lamp holder, weatherproof with 150W PAR		+	16	.500		16	16.15		47.15		۲
2550	With reflector and guard			12	.667		31 78	9.70		87.70		
2600	Interior pendent, globe with shade, 150 watt	_	<u> </u>	20	.400	-	/6	3.70		37.70	'~	-
0010	TRACK LIGHTING	١.	Fl	6.70	1.190	Ea.	33	29		62	79	
0080	Track, 1 circuit, 4' section		Elec	-	1.510	EA.	48	37		85	105	7
0100	O SECUOII			5.30	1.820		81	44		125	155	
0200		+	+	6.70	1.190		36	29		65	82	
0300	1	- 1		5.30	1.510		48	37		85	105	
0400	8' section	+	+	4.40	1.820		88	44		132	160	
0500	* ·			16	.500		12	12.15	ļ	24.15		
1000	Feed kitt, surface modified	+	+	24	.333		1.98	8.10		10.08	14.0	5
1100				16	.500		16	12.15		28.15	35	
1200		$\dashv$	+	16	.500		16	12.15		28.15	35	_
1300				32	.250		6.55		1	12.60	16.1	0
2000			+	32	.250		12.10			18.15	22	
2100				16	.500		47	12.15	1	59.15	70	
2200	Para transfer to the land		+	16	.500		101	12.15	_	113.15	130	_
3000				16	.500		102	12.15	1	114.15	130	
3100	LOW VOILING. / Watt. ) Circuit	_	<del></del>	16	.500	+	109	12.15		121.15	140	_

	Lighting		Daley	MAN			BARE (	COSTR		TOTAL	Т
<b>B</b> ee	100   Lighting	CREW	ONLY	MAN-	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL DEP	1
		1 Elec	8	1	Ea.	479	24	Davi.	503	565	1
5100	175 watt metal halide		8	- ; ]	<u> </u>	500	24		524	585	
5110	250 watt metal halide	++-	8	+		535	24		559	625	1
5120	150 watt high pressure sodium	1	8			556	24	ļ	580	645	I
5130	250 watt high pressure sodium	1				525	24		549	615	1
5140	72"H 18" sq., 400 watt metal halide		8	1 1		556	24	1	580	645	I
5150	250 watt high pressure sodium	++-	8		_	581	24		605	675	1
5160	400 watt high pressure sodium	1 *	8	1	*	361	- 27		۰	0/0	ı
5190	Portable rectangle, 6" high 13.5" x 20"				-	~~	16,15		309.15	345	t
5200	175 watt metal halide	1 Elec	12	.667	Ea.	293	16.15		330.15	370	١
5210	250 watt metal halide	+	12	.667	_	314			351.15	390	1
5220	150 watt high pressure sodium		12	.667		335	16.15		376.15	420	ı
5230	250 watt high pressure sodium	+	12	.667		360	16.15			425	1
5240	8" high 18" x 24", 400 watt metal halide		12	.667		365	16.15		381.15		١
5250	250 watt high pressure sodium		12	.667		376	16.15		392.15	435	4
5260	400 watt high pressure sodium		12	.667		398	16.15		414.15	460	ı
5270	Portable square, 15" high 13.5" sq., 175 watt metal halide		12	.667		324	16.15		340.15	380	4
5280	250 watt metal halide		12	.667		376	16.15		392.15	435	
5290	150 watt high pressure sodium		12	.667		360	16.15		376.15	420	4
5300	250 watt high pressure sodium		12	.667		386	16.15		402.15	450	
5400	Pendent 16" round/square, 175 watt metal halide		3.20	2.500		355	61		416	480	4
5410	250 watt metal halide		2.70	2.960		370	72		442	515	
5420	400 watt metal halide		2.40	3.330	Ц_	398	81		479	555	4
5430	150 watt high pressure sodium		3.20	2.500		398	61		459	525	
5440	250 watt high pressure sodium		2.70	2.960		428	72		500_	575	_
200	400 watt high pressure sodium	1	2.40	3.330	+	454	81		535	620	
											_
0010 LAI	MP8									1	
0060	Fluorescent, rapid start, cool white, 2' long, 20 watt	1 Elec	1	8	С	348	195		543	670	_
0100	4' long, 40 watt		.90	8.890		198	215		413	535	
0120	3' long, 30 watt		.90	8.890		442	215		657	805	_
0150	U-40 watt		.80	10		874	245	İ	1,119	1,325	
0170	4' long, 35 watt energy saver		.90	8.890		270	215		485	615	_
0200	Slimline, 4' long, 40 watt		.90	8.890		618	215		833	995	
0300	8' long, 75 watt		.80	10		577	245		822	990	_
0350	8' long, 60 watt energy saver		.80	10		603	245		848	1,025	
0400	High output, 4' long, 60 watt		.90	8.890		750	215		965	1,150	
0500	8' long, 110 watt		.80	10		775	245	I	1,020	1,200	
	Very high output, 4' long, 110 watt	1	.90	8.890		1,285	215		1,500	1,725	
0520			.70	11.430		1,285	275	}	1,560	1,825	
0550	8' long, 215 watt Mercury vapor, mogul base, deluxe white, 100 watt		.30	26.670		2,142	645		2,787	3,300	
0600	175 watt		.30	26.670	_	1,663	645	1	2,308	2,775	
	250 watt		.30	26.670	1 1	2,968	645		3,613	4,225	
0700	400 watt	+	.30	26.670	_	2,340	645		2,985	3,525	
0800			.20	40		5,100	970		6,070	7,025	
0900	1000 watt		.30	26.670		3,749	645		4,394	5,075	
1000	Metal halide, mogul base, 175 watt		.30	26.670	B 1	4,712	645		5,357	6,125	
1100	250 watt ( )	+	.30	26.670	_	4.386	645		5,031	5,775	
1200	400 watt		.20	40		9,894	970		10,864	12,300	
1300	1000 watt		.20	40		9.960	970	T	10,930	12,400	
1320	1000 wart. 125,000 initial lumens		.20	40		9,268	970		10,238	11,600	
1330	1500 watt	-	.30	26.670	1	4,712	645		5,357	6,125	_
60	Sodium high pressure, 70 watt				1 1	4,871	645		5,516	6,300	
	100 watt		.30	26.670	_	5,059	645		5,704	6,525	-
1370	150 watt		.30	26.670			645		6,025	6,875	
1380	250 watt	+	.30	26.670		5,380	645	+	6,372	7,250	_
1400	400 watt		.30	26.670	'	5,727	970		14,322	16,100	
1450	1000 watt		.20	40	1+	13,352		+	4,608	5,300	_
11500	Low pressure, 35 watt		.30	26.670		3,963	645		5,031	5.775	
	55 watt		.30	26.670	1	4,386	645	1	3,031	3,773	9

Distribution:

	Project No. 290 0379 000
(718) Local LD. <u>851- +577</u> Placed	
Local LD. $\frac{\partial SI^{2}}{\partial I}$ Placed	Hecd. Date Date
of American Scientific Lighting Co. Rega	HPS Lebon to
Of Merican Survivic Jamira Co. Rega	rding TII S PETIONS
	0 40
For retrofits of incandescent fix	tures, the "Bulb Lumenight
and "Colorlight" products are re	commended. The lamps are
riplaceable in both and the "c	olorlight is more whitish.
Untractore costs (inciding la	mo for quantities of 100+
and "Colorlight" products are re- riplaceable in both and the "contractors costs (including la are as follows:	
Bulb Lymenialit 35	W - \$45 / lamps only
Bulb Lumenight 35	W - \$45 (lamps only) W - \$45 (\$16-\$20) 00 W 150 W)
(also come in 70 W	00 W 150 W)
Colorlight 50 V	V - \$67 (lamps only
	V - \$67 (lamps only #30)
the sill confine the	ain cotaloa an dimension
they will send a capy of the	J. C. Commissions.



## DOWNLITE<sup>TM</sup> CONVERSION SERIES: COMPACT FLUORESCENT REFLECTOR LAMPS





### GLOBE FLECTOR™ **LUMA FLECTOR™**

- · LAMP: Compact disposable fluorescent globe or tubular lamp/Standard or tapered base
- REFLECTOR: Highly polished aluminum
- WATTAGE: Fifteen
- LUMENS: 1350
- COLOR: Warm white/2800k
- · USE: Indoor only
- . BURNING POSITION: Any
- · LAMP LIFE: 9,000 hours
- · INSTALLATION: Screws into any 120V medium base socket
- PACKAGING: Ten conversions per carton

CATALOG NUMBER	LAMP	DIMENSIONS
DGF S/15	BFG15 LE/A	Reflector Diameter 51/8" Overall Length 61/4"
DGF T/15	BFG15 LE/T	Reflector Diameter 51/s" Overall Length 63/4"
DLF S/15	BFT15 LE/A	Reflector Diameter 51/4" Overall Length 63/4"
DLF T/15	BFT15 LE/T	Reflector Diameter 51/8" Overall Length 7"

### LINE VOLTAGE/LOW VOLTAGE MR16 HALOGEN CONVERSIONS







### HALOGENLITE™ 120V

- LAMP: MR16 Dichro-Cool tungsten halogen/Medium base or intermediate with medium adapter base and clip on lens/Line voltage/Cool crisp white light 3000k/Dimmable up to twenty five percent/Medium beam spread.
- · LAMP LIFE: 2,000 hours/High lumen maintenance
- INSTALLATION: Screws directly into any ventilated 120V medium base porcelin socket rated above 100 watt/Minimum front diameter opening 43/4"
- · PACKAGING: Ten lamps per carton

### HALOGENLITE™12V

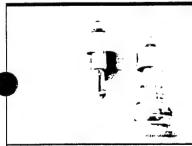
- ADAPTER: Moided Valox<sup>a</sup> plastic/Vented to cool internal
- · FINISH: Black
- I AMP•MR16 Dichro-Cool tungsten halogen/Low voltage/Stepdown transformer/Dimmable/Cool crisp white light 3000k/Natural sunlight appearance
- LIFE: 2000 hours 20 watt/3000 hours 50 watt
- INSTALLATION: DH 12/20 screws into any medium base porcelin socket rated for 75 watts/DH 12/50 into socket rated for 150 watts
- PACKAGING: Four conversions per carton/Lamp

CATALOG NUMBER	LAMP	DIMENSIONS
MEDIUM		
DH 120 M/75	JDR75	Lamp Diameter 2"
DH 120 M/100	JDR100	Overail Length 2 5/16"
INTERMEDIATE		
DH 120 I/75	JDR75	Lens Diameter 21/9"
DH 120 I/100	JDR100	Overall Length 5%"
OPTIONS: R Reflector N Narrow Beam	Spread 10°	M Medium Beam Spread 18* W Wide Beam Spread 28*

CATALOG NUMBER LAMP	DIMENSIONS			
DH 12/20 JR/20	Adapter Diameter 31/4" Overall Length 6"			
DH 12/50 JR50 DH 12/20/R40 JR/20	Adapter Diameter 31/4"			
DH 12/50/R40 JR/50	Overall Length 73/4" Lens Diameter 5"			
OPTIONS:	EXT Narrow Spot/50w			

EXZ Narrow Flood/50w BAB Flood/20w ESX Narrow Spot/20w EXN Flood/50w

## COLOR IMPROVED HPS HIGH HAT CONVERSION



### COLORLITE 50™

- ADAPTER: Heavy gauge spun aluminum
- . FINISH: Caustic etching
- · REFLECTOR: Highly polished aluminum/Vented slots for cool operation
- . LAMP COLOR: 2500K . LAMP LIFE: 12000 Hours
- INSTALLATION: Adapter screws into a standard 120V high hat fixture/Medium base porcelain socket required/ Fixture rated for a minimum of 150 watts/Minimum front diameter opening 5"
- PACKAGING: Four conversions per carton/Lamp included

CATALOG DIMENSIONS LAMP DC/50 NHT50 SDX Adapter Diameter 31/8" Reflector Diameter 51/4" Overall Height 81/2" FAX (718) 853-2390 (718) 851-4577

AMERICAN SCIENTIFIC LIGHTING CORPORATION

BROOKLYN, NEW YORK

TEL. (800) 552-3465

	RAAP Lighti	4 Projects	EP NO 290	0379000
YNOLDS, SMITH AND HILLS	SCHEMING Calco DESIGNER T. Tod	5 s	HEET	of Z
CHITECTS · ENGINEERS · PLANNERS	DESIGNER T. Tod	۵	ATE	
ECO# GP-N-9	CHECKER		OATE	
Replace all	40 W fluorescent	lamps with	34 W flo	onescents
upon failu	re *	U		
The second secon		<u> </u>	: مخمصتان درو وست	
- Assume no add' would be replaced	I labor costs a	re incurred	since lain	ps
would be replaced	langway.			<u>/                                    </u>
			A	water and the same of the same
Energy savings = 6	W x 24 hr x do	0 days = 57,	4 java	2/12/3
14	mp day	- DY	-0'	12/1/
Cost Course = 37	4 K.L 10.020	26 - \$1.13		
Cost Savings = 37.	yr turk	yr	***************************************	
	0			According to the Control of the Cont
Mat'l cost = cost	of 34W flaor -	cost of 40W	Auor.	
Mat'l cost = cost = \$2.7	0 - \$1.98 = \$	0.72	! 	
Project cost =	\$ 0.72 × 1.045 =	\$0.75 / lan	np	
The same of the first term of the same of	and the spine that the per compact different millionist the second as the spin of the second	Management and September Special Special September Special Septemb	U	
Simple payback=	$\frac{$0.75}{4} = 0.7$	yr		
	71.13/yr			
life of la	1 = 16 000 hr	ur - 3	. 2 ur >	0.7 w
piqe or rain	= 20,000 hr x	240 hr	3.	3
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the second contract of the second contract of		entermination assume the section of the section of	- ,	

GP-N-9

p. 20+2

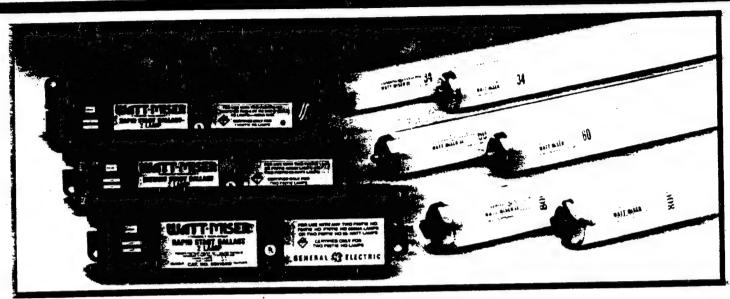
			DAILY	MAN-			BARE			TOTAL	1
71	66 100   Lighting	CREV	OUTPU	HOURS	TINU	MAT.	LABOR	EQUIP.	TOTAL	INCL OAP	Ļ
100	175 watt metal halide	1 Ele	c 8	1	Ea.	479	24		503	565	1
110	250 watt metal halide		8	1		500	24		524	585	1
120	150 watt high pressure sodium		8	1		535	24		559	625	1
130	250 watt high pressure sodium		- 8	1		556	24		580	645	1
140	72"H 18" sq., 400 watt metal halide		8	1		525	24		549	615	ı
150	250 watt high pressure sodium		8	1		556	24		580	645	1
160	400 watt high pressure sodium	1	8	1	+	581	24		605	675	ı
190	Portable rectangle, 6" high 13.5" x 20"	1				·					1
200	175 watt metal halide	1 Ek	c 12	.667	Ea.	293	16.15		309.15	345	ı
210	250 watt metal halide		12	.667		314	16.15		330.15	370	4
220	150 watt high pressure sodium		12	.667		335	16.15		351.15	390	ı
230	250 watt high pressure sodium		12	.667		360	16.15		376,15	420	4
240	8" high 18" x 24", 400 watt metal halide		12	.667		365	16.15		381.15	425	ı
250 5250	250 watt high pressure sodium		- 12	.667		376	16.15		392.15	435	1
5260	400 watt high pressure sodium		12	.667		398	16.15		414.15	460	ı
	Portable square, 15" high 13.5" sq., 175 watt metal halide		12	.667		324	16.15		340.15	380	1
5270 5280	250 watt metal halide		12	.667		376	16.15		392.15	435	
5290	150 watt high pressure sodium		12	.667		360	16.15		376.15	420	1
5300	250 watt high pressure sodium		12	.667		386	16.15		402.15	450	1
5400	Pendent 16" round/square, 175 watt metal halide		3.20	2.500		355	61		416	480	1
5410	250 watt metal halide		2.70	2.960		370	72		442	515	ł
	400 watt metal halide		2.40	3.330		398	81		479	555	1
5420 5430	150 watt high pressure sodium		3.20	2.500		398	61		459	525	1
5440	250 watt high pressure sodium		2.70	2.960		428	72		500	575	1
5450	400 watt high pressure sodium		2.40	3.330		454	81		535	620	1
200	400 Wall high process of column	1									_
0010	LAMP8										
0080	and the state of t	18	ec 1	8	С	348	195		543	670	┙
0100			.90	8.890		198	215		413	535	1
0120			.90	8.890		442	215		657	805	4
0150		$\top$	.80	10		874	245		1,119	1,325	١
0170			.90	8.890		(270)	(215)		485	615	_
0200			.90	8.890	TT	618	215		833	995	1
			.80	10		577	245		822	990	┙
0300			.80	10		603	245		848	1,025	Į
0350			.90	8.890		750	215		965	1,150	_
0400			.80	_		775	245		1,020	1,200	1
0500			.90			1,285	215		1,500	1,725	┙
0520			.70	_	_	1,285	275		1,560	1,825	-
0550			.30			2,142	645		2,787	3,300	⅃
0600			.30	_		1,663	645		2,308	2,775	
0650			.30			2,968	645		3,613	4,225	
0700			.30	-	_	2,340	645		2,985	3,525	
0800			.20			5,100	970		6,070	7,025	┙
0900			.30	_	0	3,749	645		4,394	5,075	
1000			.30	1		4,712	645		5,357	6,125	╝
1100			.30			4,386	645		5,031	5,775	
1200			.20	1		9.894	970		10,864	12,300	
1300			.20			9,960	970		10,930	12,400	
1320			.20			9,268	970		10,238	11,600	
1330		1	.30	_	0	4,712	645		5,357	6,125	
1350			.30			4,871	645		5,516	6,300	
60		+	.30	_	_	5,059	645		5,704	6,525	
1370			.30			5,380	645		6,025	6,875	
1380		+	.30	_	_	5,727	645		6,372	7,250	٦
1400		1	.20			13,352	970	1	14,322	16,100	
1450		+-	.30	_	_	3,963	645		4,608	5,300	
	Low pressure, 35 watt		4	/13 0/	I						1

	RAAP	Lighting Projects	190 037900D
	Screenia	Calca	AEP NO 790 0379000 SHEET OF 3
REYNOLDS, SMITH AND HILLS	7	Lighting Projects Cales Toold	DATE
INCORPORATED	DESIGNER		DATE
€CO # GP- N-1	O		
Replace all 5	tandard effi	ciency fluorescent pon failure	ballasts with
high afficience	y ballasts w	pon failure	
	·		
- Assume no addit	ional labor	costs would be i	ncurred since
ballasts would be	replaced a	nyway.	
- Assume no addit ballasts would be - Assume 2 lamps per	ballast for 4	Ufixadres.	en en en en en en en en en en en en en e
Energy savings =	96-2(40)	- [71-2(34)] W=	13 W/fixture
- Enough	ا <b>ر ب</b> الله المستدور		
	13W , 24 1	$\frac{260 \text{ days}}{y} = \frac{3}{2}$	31 kwh perfixture
f	exture dan	1 yv	4
	, · <u> </u>	) 0	0 = 27 mg
Cost savings = 81 k	wh x \$0.030	26 = \$2.45 per	fixture
Cost savings = 81 k	2 kurh	<u> </u>	
		(	and the second s
Mut'l lost = cost	ot evergy erra	ent ballast - cost	of standard ballast
		.86) × 1.05 inflat	
Project cost	= \$ 6.38 ×	1.045 = \$6.67	T.
Simple paulosoft =	\$ 6.67	- 1.7 uv	
Simple paubach =	12.45/W		
		- 4	
LITE OF BAIL	last - 27	yr > 2.7 yr P	W. Burst
		_	

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## GE WATT-MISER" BALLASTS USE LESS VATTS PER FIXTURE TO DELIVER GH ENERGY SAVINGS



### Watt-Miser Ballasts

- Compatible with standard or energy-saving lamps (3-lamp WM ballast compatible only with ES lamps)
- Cooler operation extends ballast life
- Dimensionally interchangeable with standard ballasts.
- CBM-certified by ETL with standard lamps. (3-lamp WM ballast not CBM certified)
- · UL-listed. Class P.

The GE Watt-Miser ballast is inherently more energyefficient than a standard ballast. Even greater savings come from pairing Watt-Miser ballasts with today's popular reduced-wattage lamps. Watt-Miser ballasts are offered for 4' Rapid Start; 8' Instant Start; and 8' High Output applications. A 3-lamp Watt-Miser ballast in a standard rapid start case is available for use with four-foot energysaving lamps. The chart shows fixture watts and energy \$ that can be saved by replacing standard lamps and ballasts with Watt-Miser ballasts and energy-saving lamps.

### amn Ballast System Replacement Chart

	Standard Sy	stem(1)		Watt-Miser System				
Fluorescent Fixture Type	Lamp Type	Watts Per Fixture	Lamp Type <sup>(2)</sup>	Watt- Miser Ballast <sup>(4)</sup>	Watts Saved Per Fixture	Energy <sup>(2)</sup> \$ Saved Per Fixture		
4-LAMP TROFFER	F40 181 F40 (34W) 159		F40LW/RS/WMII F40LW/RS/WMII	(2)8G1024W (2)8G1024W	41 19	\$ 9.84 \$ 4.56		
3-LAMP TROFFER	F40	149	F40LW/RS/WMII	(1)8G1024W and (1)8G1074W (1)8G1324W	40 43	\$ 9.60 \$10.32		
2-LAMP INDUSTRIAL	F40 F96T12 F96T12/HO	96 172 255	F40LW/RS/WMII F96T12/LW/WMII F96T12/LW/HO/WMII	8G1024W 8G1004W 8G1154W	25 46 56	\$ 6.00 \$16.56 \$20.16		
2-LAMP, SURFACE- MOUNT, WRAP AROUND	F40	82	F40LW/RS/WMII	8G1024W	16	\$ 3.36		
4-LAMP, SURFACE- MOUNT, WRAP AROUND	F40	165	F40LW/RS/WMII	(2)8G1024W	32	\$ 6.72		

<sup>(1)</sup> Fixture equipped with standard ballast and lamp shown.

<sup>(2)</sup> Other energy-saving lamps may be used to obtain similar savings.

<sup>(3)</sup> Annual energy savings at 8° KWH; 3000 Hrs. -- F40; 4500 Hrs. -- F96.

<sup>(4)</sup> Ballast codes snown are 120-volt. For complete application information, ee product tables.

p. 3 of 3 GP-N-HOWER

# PTAC No. 865911

## reynolds; smith and hills

Local 396-7446 L	D. 988-7351	Placed_	Rec'd_	Dat	e. 5-27-87
T. Mas	ters	_ Conver	sed withStan	- Jefson /	
OF G.E. Lamp MA	wketing / Enginee	vina Re	garding balla	sts	a.s.
	<b>.</b>		··.	and the second second	The second secon
Stan Jetson	provided cost	s, Jo	e Howley pr	ovided wall	ages light
output life	times		J		
4 ft			Cost	Life (ful	ction of heat)
Standard	8G 10ZZWF	(5)	\$15,86	10-12 yr	
Wattmiser	8G 1024 WF	( w)	(121.94)	24 ur	
MaxinuserII	891028WF	(M)	\$ 77.89	24 yr	energy-
optimiser	M28-120F	(0)	\$34.10	30 yr	
- Maximise	II - patew	ted, for	ell light out	put using a	ergy saving
	Laure	may	be aire to del	and with the	i one
- Ophimiser	- potented			9	
8 ft					
Standard	861011WF	(5)	\$ 25.90	12 yr	
Watthiser	861004 WF	(w)	\$ 36.86	24 yr	
Maximiser II	861008 WF	= (m)	\$39.17	24 yv	
Distribution:					

### REYNOLDS, SMITH AND HILLS ARCHITECTS • ENGINEERS • PLANNERS INCORPORATED

SUBJECT RAAP EAAP

Install Strip Curtains SHE

DESIGNER W. T. Todd DAT

CHECKER DAT

AEP NO 290-0379-000 SHEET 1 OF DATE 6-11-90

ECO#GP-W-1

INSTALL VINYL STRIP CURTAINS

## Assumptions:

- 1. The average outdoor air temperature is 45°F.
- 2. The indoor design temperature is 75 of.
- 3. Average wind speed is 9 knots according to the facility Design and Planning, Engineering Weather Data, Department of the Army Technical Manual. Assume the average wind speed at the door openings is 3 miles per hour.
- 4. Assume a door opening of 8 feet by 8 feet, and the door(s) are open for I shift perday.

## Calculations:

Q1055 = in Cp AT

m = 3 miles x 5280 ft x 8ft x 8ft x 8ft x 116 = 75,093 lb/hr

Cp = 0.24 Btn/16-0F

AT = 75°F - 45°F = 30°F

Q<sub>loss</sub> = 75,093 \(\frac{16}{hr}\) \times 0.24 \(\frac{\text{Btu}}{160F}\) \times 30°F = 0.5 \(\frac{\text{mBtu}}{hr}\)

The savings occur 8760 \frac{hr}{Yr} \times \frac{8hr}{12-0} \times \frac{8hr}{24hr} = 973 hours per year if utilized for the months of December - March when the normal claily mean temperature is 41 of.

## REYNOLDS. SMITH AND HILLS ARCHITECTS · ENGINEERS · PLANNERS INCORPORATED

SUBJECT	RAAP EEAP
	stall Strip Cartains
	W.T. Todd
CHECKER	<u> </u>

AEP NO
SHEET \_\_\_\_\_\_OF\_\_\_\_
DATE

<u>GP-W-1</u> Calculations (continued):

Steam Savings =

0.5 MBtu/hr x 973 hr/yr x 25 bldgs = 12,162.5 MBtu/yr

Coal Savings :

12,162.5 mBtn/yr \* 1.32 = 16,055 metn/yr

16,055 inetalyr x \$1.61 /meta = 25,849 /yr

Elec. Price Diff. Costs

12,163 MBtu/yr \* # 1.11 = #13,501/yr

Project (ost:

Construction Cost = # 18,247 See Cost Estimate Sheet

Simple Payback:

Payback = Cost = Cavings =  $^{$\pm 18,247 = (\pm 25,849/\gamma_r - \pm 13501/\gamma_r)$}$ =  $^{$\pm 18,247 = \pm 12,348/\gamma_r = 1.5 \text{ year}}$ 

## REYNOLDS, SMITH AND HILLS ARCHITECTS • ENGINEERS • PLANNERS INCORPORATED

SUBJECT RAAP EEAP	AEP NO
Install Strip Curtains	
DESIGNER W. Torrodd	
CHECKER	DATE

Buildings Identified During Survey With Potential For Utilization Of Clear Vinyl Strip Curtains.

Area	No. Bldgs.	Typ. Bldg. No.	Building Name
Sol. Rec.	15	1611-00	Solvent Recovery
NC-BÉC	2	2010-00	Dry House & Conveyor
NC-B & C	2	2026-00	Final Wringer House
1st RP	1	7113-00	Roll House
4th RP	4	9309-04	Rolled Powder
Rocket		4924-01	Motor Load House
Total	25		

and the second segment of the second segments of the second second segments of the second segments of the second segments of the second segments of the second segments of the second segments of the second segments of the second second segments of the second segments of the second

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CONSTRUCTION COST	ESTIMA	ΓE		DATE PREPARED	-12-	90	SHEET	4 of
ROJECT ENERGY ENGINEERING					BASIS FOR ESTIMATE			
RADFORD ARMY AMMUN				CODE & (No design completed				
ARCHITECT ENGINEER REYNOLDS, SMITH AN	D HILLS	A.E.	P., II	CODE C (Final decign)			ni gn)	
DRAWING NO.		ESTIM	ATOR	.T. Todd		CHECKE	27	
	QUANT	ITY		LABOR		MATERIAL	L	
Strip Curtains SUMMARY	NO. ETINU	UNIT	PER	TOTAL	PER	тот	PAL	COST
B'x B' Vinyl Strip Door		Ea.	100	100,00	354	35	4.00	454.00
Sales Tax					4.5%	1.	5.93	15.93
FICA/Insurance			20%	20,00		-		20.00
							<del> </del>	11.00.02
Subtotal	1							489.93
Overhead	1500	'	•					73.49
Profit	10 70						<del></del>	56.34
Performance Bond	10%							6.20
Hercules Support	670							37.56
Contingency	10 %						-	66.35
C 1								720 07
Subtotal								729.87
x 25 Buildings	-						· · · · · · · · · · · · · · · · · · ·	×25
Construction Cost								#18,246.75
								,
							• .	•
•								
				·	·			
Source = Grainger per year to take 4	Cata	log	, 198	B, pg. 820	, I	nevea	ised	by 5%.
per year	for	198	9 an	d 1990.	Labo	vw	as a	ssumed
to take 4	manha	1's a	+ #	25 per h	our.			

77	0.7	
H		77
		(2)

SUBJECT		AEP NO	AEP NO		
	•	SHEET	OF		
DESIGNER	G. FALLON	DATE	14/90		
CHECKER	P. HUTCHINS	DATE 6	14/90		

# ECO# GP-X-1 REDUCE EXIT GAS TEMP. IN INCINERATOR

THE COMBUSTION PROGRAM WAS ADAPTED TO DETERMINE EXIT GAS HEAT LOSS BY ZEROING THOSE INPUT PARAMETERS APPRICABLE TO BOILERS. THE INPUT" PAGE SHOWS THE VALUES THAT WERE ZEROED.

THE INCINERATOR RECEIVES 3,9 9pm (22000 LBS/HR) OF WATER.

THE OIL FLOW WAS ITERATED UNTIL THE HEAT ADDED

EQUALLED THE HEAT LOST IN THE 500° EXIT GASES. AT

THIS POINT THE MASS & ENERGY FLOWS BALANCE.

TO GENERATE THE GRAPH, THE EXIT GAS TEMPERATURE WAS INCREASED IN 100° INCREMENTS. THE PROSERM CALCULATES THE HEAT CONTENT OF THE COMPUSTION PORODUCTS (ENERGY LOSS) FOR EACH EXIT TEMPERATURE. THE ENERGY LOSSES WERE THEN ANNUALIZED AND ADTUSTED FOR INCINERATOR LOAD FACTOR AS FOLLOWS:

ANNUAL ENERGY LOSS & SOUF EGT ENERGY LOSS FROM PAGE 2 IS 2.88 MBTU/HR INCINERATOR DATA INDICATES A 50% LOAD FACTOR.

2.88 mBTU/nr. × 8760 H9/4r × ·5 = 12614 MBTU/Yr

BUT THIS IS BASE OF GRAPH SO 12614-12614=0

0 = GRAPH VALUE

ANNUAL ENERGY LOSS FROM PAGE 5 IS 4.97 MBTU/MIL

4.97 MBTW/HR X 8760X .5 = 21768 MBTUL ENERGY SAVINGS

RELATIVE TO 500° F RASE - 21768 - 12614 = 9154 MBTU/yr = 6RAPH VALUE. 1962 2 11111 1200 200 200 11 13558 WYTU/1/2

CLIENT	COE		[	DATE	14-Jun-90
PLANT -	RAAP.		TIME		12:44 PM
FUEL ULTIMATE	ANALYSIS	00V 5U5	007.4	ADTHETED	
CONSTITUENT	WT.PCT.	RECEIVED	DRY & ASH FREE	ADJUSTED FUEL	
CARBON	9.85	86.40	86.40	86.40	
HYDROGEN	1.45	12.70	12.70	12.70	
OXYGEN	0.01	0.10	0.10	0.10 0.10	
NITROGEN	0.01 0.08	0.10 0.70	0.10	0.70	
SULFUR CHLORINE	0.00	0.70	0.00	0.00	
WATER	88.60	0.00	0.00	0.00	
INERTS	0.00	0.00	0.00	0.00	
TOTAL.	100.00	100.00	100.00	100.00	
FUEL DATE / TO	DNC (DAY )			27	
FUEL RATE (TO TOTAL AIR ASS				115	
FUEL HIGHER H		F (BTU/LB)		1274	
HEAT LOSS DUE				0.00	
CARBON IN RES			•	0.00	
EXIT GAS TEMP		g. F)		500	
AMBIENT DRY E	BULB TEMP (D	eg.F)		80	
HUMIDITY RATI				0.0132	
BAROMETRIC PR		Hg.)		29.92	
RADIATION LOS				0.00	
UNACCOUNTABLE		/ OTIL // O \		0.00	
ENTHALPY ADDE	LU IN BUILER	(RIO/FR)		U	

0 U T P U T-0 U T

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP	TIME	12:44 PM

HEAT LOSSES .	MMBTU/HR	PERCENT
IN DRY FLUE GAS	0.44	15.40
FROM H20 IN AIR	0.00	-0.08
FROM H20 IN FUELSENSIBLE	-0.09	-3.15
FROM H20 IN FUELLATENT	2.53	87.83
TOTAL IN WET FLUE GAS	2.88	100.00
DUE TO UNBURNED CARBON	0.00	0.00
DUE TO HOT ASH	0.00	0.00
DUE TO RADIATION & UNACCOUNTABLE	0.00	0.00
TOTAL	2.88	100.00

BOILER EFFICIENCY (%)	0.00
STEAM GENERATED (LBS/HR)	ERR
UNBURNED CARBON (LBS/HR)	0
LBS OF WET FLUE GAS PER LB FUEL	2.90
SPEC.VOL.OF WET FLUE GAS (CU.FT./LB)	28.72
AIR TO FUEL RATIO (LB AIR/LB FUEL)	1.88
COMB. AIR SPECIFIC VOL. (CU.FT/LB)	13.712
COMBUSTION AIR FLOW (LBS/HR)	- 4295

### FLUE GAS ANALYSIS

•	% BY VOLUME		% BY WEIGHT	
	WET DRY		WET	DRY
002	6.89	13.39	12.43	19.38
S02	0.0209	0.0406	0.0549	0.0856
02	1.49	2.89	1.95	3.04
HCL	0.0000	0.0000	0.0000	0.0000
N2	43.08	83.68	49.72	77.49
H20	48.52		35.83	

### FLUE GAS FLOWS

	WET	ORY
MASS (LBS/HR)	5552	4204
VOLUME (ACFM)	3137	1615
(SCFM)(70DEG.F.)	1732	891
@ 12% CO2	995	995
"F" FACTOR		
(DSCF/MMBTU @12% CO2)		20749

CLIENT	COE		0	DATE	14-Jun-90
PLANT	RAAP		. 1	IME	12:46 PM
FUEL ULTIMATE		ORY FUEL	NDV 1	AN THSTEN	
CONSTITUENT	WT.PCT.			FUEL	
CARBON	9.85	86.40			
HYDROGEN		12.70			
OXYGEN	0.01 0.01	0.10 0.10	0.10 0.10		
NITROGEN SULFUR	0.08	0.70	0.70		
CHLORINE	0.00	0.00	0.00	0.00	
WATER	88.60	0.00	0.00	0.00	
INERTS	0.00	0.00	0.00	0.00	
TOTAL	100.00	100.00	100.00	100.00	
FUEL RATE (TO	NS/DAY)			27	
TOTAL AIR ASS				115	
FUEL HIGHER H				1274	
HEAT LOSS DUE TO UNBURNED CARBON (%)		0.00			
CARBON IN RES		a	0.00		
AMBIENT DRY B				80	
	HUMIDITY RATIO (LBS H2O/LB DRY AIR)			0.0132	
BAROMETRIC PR	RESSURE (IN.			29.92	
RADIATION LOS				0.00	
UNACCOUNTABLE ENTHALPY ADDE		(9111/19)		0.00	
FNIHALPT AUDE	אל וונוא מו נו	\ D   U / L D /		V	

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP	TIME	12:46 PM

HEAT LOSSES	MMBTU/HR	PERCENT
IN DRY FLUE GAS	1.46	50.59
FROM H20 IN AIR	0.02	0.82
FROM H20 IN FUELSENSIBLE	0.97	33.62
FROM H20 IN FUELLATENT	2.53	87.83
TOTAL IN WET FLUE GAS	4.97	172.86
DUE TO UNBURNED CARBON	0.00	0.00
DUE TO HOT ASH	0.00	0.00
DUE TO RADIATION & UNACCOUNTABLE	0.00	0.00
TOTAL	4.97	172.86

BOILER EFFICIENCY (%)	-72.86
STEAM GENERATED (LBS/HR)	ERR
UNBURNED CARBON (LBS/HR)	.0
LBS OF WET FLUE GAS PER LB FUEL	2.90
SPEC.VOL.OF WET FLUE GAS (CU.FT./LB)	55.65
AIR TO FUEL RATIO (LB AIR/LB FUEL)	1.88
COMB. AIR SPECIFIC VOL. (CU.FT/LB)	13.712
COMBUSTION AIR FLOW (LBS/HR)	4295

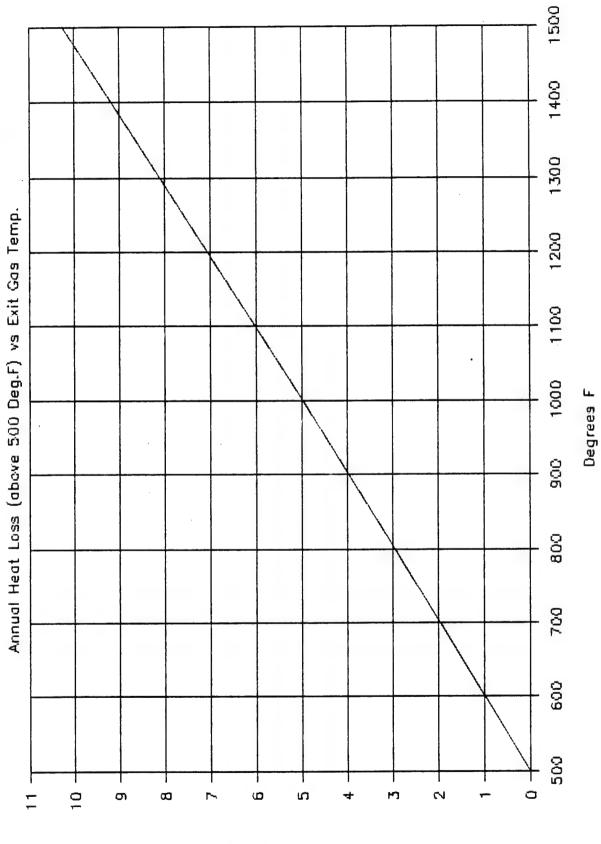
### FLUE GAS ANALYSIS

	% BY VOLUME		% BY WE	IGHT
	WET	DRY	WET	DRY
002	6.89	13.39	12.43	19.38
S02	0.0209	0.0406	0.0549	0.0856
02	1.49	2.89	1.95	3.04
HCL	0.0000	0.0000	0.0000	0.0000
N2	43.08	83.68	49.72	77.49
H20	48.52		35.83	

### FLUE GAS FLOWS

	WET	DRY
MASS (LBS/HR)	6552	4204
VOLUME (ACFM)	6077	3129
(SCFM)(70DEG.F.)	1732	891
@ 12% CO2	995	995
"F" FACTOR		
(DSCF/MMBTU @12% CO2)		20749

Radford Army Ammunition Plant



Annual Heat Loss (Mbtu)
(Thousands)

RSH	•
	)

SUBJECT		AEP NO		
		SHEET	OF	
DESIGNER	G. FALLON	DATE	14/90	
CHECKED	P. Huthins	DATE	0114/90	

ECO# GP-X-2 REDUCE WATER FLOW INTO INCINERATION

The Combustion program was adapted to Eliminate boiler Absorbtims of Heat by Zeroing the appropriate parameters. Those are shown on the "INPUT" pages of the ENCLOSED TUNS.

THE INCINERATOR EVAPORATES 2000 LBS/HR OF WATER. THE
FUEL FLOW DECESSARY TO ACCOMPLISH THAT WHILE MAINTAINING
A 1000°FEXIT GAS TEMPERATURE WAS DETERMINED BY ITERATION.
This relationship was subsequently maintained FOR THE
REMAINING COMPUTER PURS.

The graph was Generated by Varying THE WATER FLOW (and therefore Fuel Flow) while maintaining The 1000'F Exit GAS Temperature.

ENEIRLY LOSS OF 2000 LRS HE HLO
COMPUTER SHEETS

ENERGY LOSS From PAGE 1 = 4.45 MBTL /HR

ENERRY LOSS OF 1800 -35/HR HLO

COMPUTER SHEETS

ENERGY LOSS FROM PAGE = 4,00 MBTU/HR

PNNUAL ENERGY SAVED FROM EACH INCINERATOR

DATA SHOWS 50% INCINERATOR LOAD FACTOR

(4.45-4.00) mbttex 8760 1/4rx.5 = 197/ MB+u/yr

ENERGY SAVINGS FOR BOTH INCINERATORS

1971 MBTU/yr x2 = 3942 MBTU/yr

RSH	•
	b

SUBJECT		AEP NO	
		SHEETOF	
DESIGNER	PFH	DATE10/29/96	
CHECKER		DATE	

For PRIP

Current energy use for 1 incinerator

From Table z-1 annual quel oil bill is #343,763 (Other, # z fuel oil)

For one incinerator # 343,763/z = \$ 171,882/yr.

Savings for one incinerator hydroclone is

3942/2 = 1971 MBta Jueloil

Value of savings =

1971 \* #4.27 = #8416/yr.

CLIENT	COE		{	DATE	14-Jun-90
PLANT	RAAP	ng agus and man and sale also dep der		TIME	12:31 PM
FUEL ULTIMATE	A <b>NA</b> LYSIS	DRY FUEL	ORY &	ADJUSTED	
CONSTITUENT	WT.PCT.		ASH FREE		
CARBON	12.48	86.40	86.40	86.40	
HYDROGEN	1.83	12.70	12.70	12.70	
OXYGEN	0.01	0.10		0.10	
NITROGEN	0.01	0.10	0.10	0.10	
SULFUR	0.10	0.70	0.70	0.70	
CHLORINE	0.00	0.00	0.00	0.00	
WATER	85.56	0.00	0.00	0.00	
INERTS	. 0.00	0.00	0.00	0.00	
TOTAL	100.00	100.00	100.00	100.00	

FUEL RATE (TONS/DAY)	28	
TOTAL AIR ASSIGNED (%)	115	
FUEL HIGHER HEATING VALUE (BTU/LB)	1902	
HEAT LOSS DUE TO UNBURNED CARBON (%)	0.00 -	
CARBON IN RESIDUE (%)	0.00	
EXIT GAS TEMPERATURE (Deg. F)	1000	
AMBIENT DRY BULB TEMP (Deg.F)	80	
HUMIDITY RATIO (LBS H2C/LB DRY AIR)	0.0132	
BAROMETRIC PRESSURE (IN.Hg.)	29.92	
RADIATION LOSS (%)	0.00	
UNACCOUNTABLE LOSS (%)	0.00	
ENTHALPY ADDED IN BOILER (BTU/LB)	0	

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP	TIME	12:31 PM

HEAT LOSSES	MMBTU/HR	PERCENT
IN DRY FLUE GAS	1.31	29.37
FROM H20 IN AIR	0.02	0.35
FROM H20 IN FUELSENSIBLE	0.50	11.21
FROM H20 IN FUELLATENT	2.63	59.06
TOTAL IN WET FLUE GAS	4.45	100.00
DUE TO UNBURNED CARBON	0.00	0.00
DUE TO HOT ASH	0.00	0.00
DUE TO RADIATION & UNACCOUNTABLE	0.00	0.00
TOTAL	4.45	100.00

BOILER EFFICIENCY (%)	0.00
STEAM GENERATED (LBS/HR)	ERR
NBURNEO CARBON (LBS/HR)	0
LBS OF WET FLUE GAS PER LB FUEL	3.41
SPEC.VOL.OF WET FLUE GAS (CU.FT./LB)	42.47
AIR TO FUEL RATIO (LB AIR/LB FUEL)	2.38
COMB. AIR SPECIFIC VOL. (CU.FT/LB)	13.712
COMBUSTION AIR FLOW (LBS/HR)	5635

### FLUE GAS ANALYSIS

	% BY VOLUME		% BY WE	IGHT
	WET	DRY	WET	DRY
C02	7.64	13.39	13.41	19.38
S02	0.0232	0.0406	0.0592	0.0856
02	1.65	2.89	2.11	3.04
HCL	0.0000	0.0000	0.0000	0.0000
N2	47.77	83.68	53.61	77.49
H20	42.91		30.81	

## FLUE GAS FLOWS

	WET	DRY
MASS (LBS/HR)	7972	5516
VOLUME (ACFM)	5643	3222
(SCFM)(70DEG.F.)	2049	1170
₱ 12% CO2	1305	1305
"F" FACTOR		
(DSCF/MMBTU @12% CO2)		17605

**************************************	<b>*************</b>
INPUT- INPUT- INPUT- INPUT- IN	PUT- INPUT-
****************	*************

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP	TIME	06:54 PM

FUEL ULTIMATE ANALYSIS				
CONSTITUENT	WT.PCT.	DRY FUEL RECEIVED	DRY & ASH FREE	ADJUSTED FUEL
CARBON	12.48	86.40	86.40	86.40
HYDROGEN	1.83	12.70	12.70	12.70
OXYGEN	0.01	0.10	0.10 0.10	0.10 0.10
NITROGEN Sulfur	0.01 0.10	0.70	0.10	0.70
CHLORINE	0.10	0.00	0.00	0.00
WATER	85.56	0.00	0.00	0.00
INERTS	0.00	0.00	0.00	0.00
TOTAL	100.00	100.00	100.00	100.00

FUEL RATE (TONS/DAY)	25
TOTAL AIR ASSIGNED (%)	115
FUEL HIGHER HEATING VALUE (BTU/LB)	1902
HEAT LOSS DUE TO UNBURNED CARBON (%)	0.00
CARBON IN RESIDUE (%)	0.00
EXIT GAS TEMPERATURE (Deg. F)	1000
AMBIENT DRY BULB TEMP (Deg.F)	80
HUMIDITY RATIO (LBS H2O/LB DRY AIR)	0.0132
BAROMETRIC PRESSURE (IN.Hg.)	29.92
RADIATION LOSS (%)	0.00
UNACCOUNTABLE LOSS (%)	0.00
ENTHALPY ADDED IN BOILER (BTU/LB)	0

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP	TIME	06:54 PM

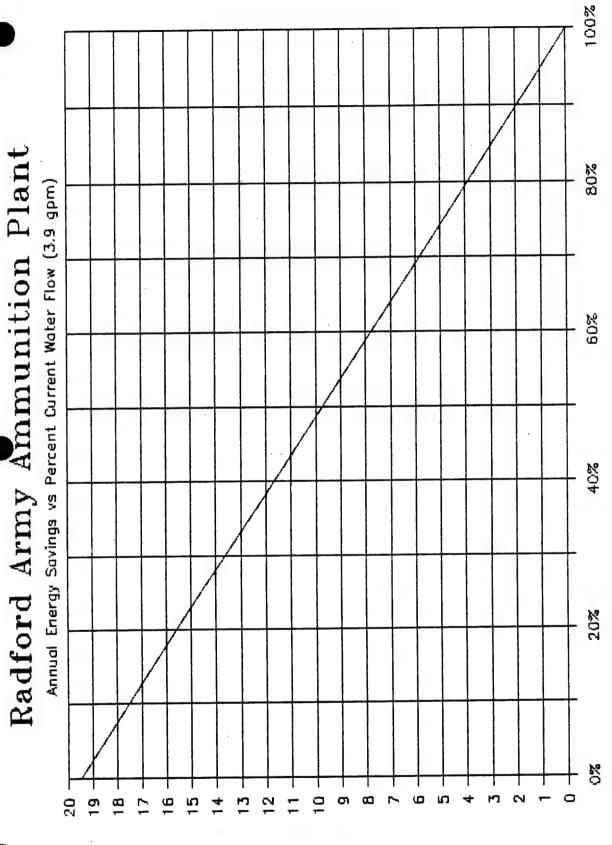
HEAT LOSSES	MMBTU/HR	PERCENT
IN DRY FLUE GAS	1.18	29.37
FROM H20 IN AIR	0.01	0.35
FROM H20 IN FUELSENSIBLE	0.45	11.21
FROM H20 IN FUELLATENT	2.36	59.07
TOTAL IN WET FLUE GAS	4.00	100.00
DUE TO UNBURNED CARBON	0.00	0.00
DUE TO HOT ASH	0.00	0.00
DUE TO RADIATION & UNACCOUNTABLE	0.00	0.00
TOTAL	4.00	100.00

### FLUE GAS ANALYSIS

% BY VOLUME		% BY WE	IGHT	
	WET	DRY	WET	ORY
C02	7.64	13.39	13.41	19.38
S02	0.0232	0.0406	0.0592	0.0856
02	1.65	2.89	2.11	3.04
HCL	0.0000	0.0000	0.0000	0.0000
N2	47.77	83.68	53.61	77.49
H20	42.91		30.81	

### FLUE GAS FLOWS

	WET	ORY
MASS (LBS/HR)	7175	4964
VOLUME (ACFM)	5079	2899
(SCFM)(70DEG.F.)	1844	1053
@ 12% CO2	1174	1174
*F* FACTOR		
(DSCF/MMBTU @12% CO2)		17605



Annual Energy Savings (Mbtu)

Current Water Flow (%)

## **Telephone Call Confirmation**

							7 - 0 0 0
Local	<u> </u>						e 5-22-90
				Conversed Wit	h		(404) 394-620
Of _	SOOR	R OLIV	ER	Regarding	Hypro	CLONES	
					•		
111 4	HUDRAC	LONE	cor	rect cl	PR.	OVIDED	PARTICLES
CAN	PASS	4 mm	DRIFIC	ce w	il get	50/5	O SPLIT
Dow	N TO	30 Ju	21	50 PS1	$\Delta P$ .	COST	is \$100.00
			***				
		•					
			· · · · · · · · · · · · · · · · · · ·				
· · · · · · · · · · · · · · · · · · ·		·					
· · · · · · · · · · · · · · · · · · ·		<del></del>					
	T						

CONSTRUCTION COST	ESTIMA	ΓE		DATE PREPARED			OF	
PROJECT ENERGY ENGINEERING	ANAL YS	IS			BASIS FO	OR ESTIM	ATE	
RADFORD ARMY AMMUN			•		1 / -	_	(No designal)	n completed) design)
ARCHITECT ENGINEER								
REYNOLDS, SMITH AND	HILLS	A.E.		NC.	000	HER (Sp		
DRAWING NO.				LLON		CHECKE	QA	
ADD HYDROCLONE SUMMARY	QUANT	ŤΥ		LABOR		MATERIA	L	
TO INCIN. SCURRY LINE	NO. ETINU	UNIT MEAS.	PER	TOTAL	PER	то:	TAL	COST
IN HYDROCLONE	- 1	EA	30	30	#100	1	00	/30
1"316SS pipe	300	ft	3.99	1197	7,42	22	26	3423
FibergLASS INSULATion								
@ SERVICE JACKET								
I"WALL, I"piece	300	\$T	1.56	468	1.37	4	11	879
·								
SUB TOTAL			•	1695		27	37	4402
LOCATION			.683	1158	1.002	27	42	3900
	1							
SALES TAX 4.5	10/			0			23	123
S NP 40447	917			1158		28	65	4023
FICA/INSURANCE	1010)		•					805
SUB TOT						***********		4828
OH (15%)					1			724
SUB 407 PROFIT (10%)						· · · · · · · · · · · · · · · · · · ·		5552
PROFIT (10%) SUB 107						••		555
BOND (1%)								6107
707 BUS								1.110
CONTINGENCY (7,5%	)							1168 463
SUB 407.			-	·				6631
Hercules Supportes	)							393
TOTAL								7029
				Two h	sdro	lon	4	1/2
				(			-	1
				1	OTAL	,		#14.058
								,

RSH	
	•

SUBJECT		AEP NO	AEP NO						
		SHEETOF							
DESIGNER	G. FALLON	DATE 6/14/90	<u> </u>						
CHECKER	P. HUTCHINS	DATE 6/14/90	•						

ECO # GP-X-3 REDUCE INCINERATION EXCESS AIR

COMBUSTION PROGRAM

THE BOILER/COMBUSTION PROGRAM NAS ADAPTED TO IGNORE HEAT ABSORBTIONS BY ZEROING BOILER RELATED INDUT

WITH THE MASS FENERAY FLOWS BALANCED FOR A 1000°F EXIT GAS TEMPERATURE AND 115 % AIR FLOW, THE HEAT LOSSES IN THE STACK GASES ARE 4.45 MBTU/HR (PAGE 2). FOR 300% AIR FLOW (25% OL IN STACK) The LOSSES ARE 6.57 MBTU/HR (PAGE 5).

ANNUAL ENERGY SAVINGS

(6,57 - 4,45) MOTUL/HR X 3760X . 5 = 9286 M8TU/47

FOR BOTH INCINERATORS

9286 XZ = 18572.1718TU/yr.

COST SAVINGS

18572 MBTU/yrx \$4.27 /MBTU = \$79,300/yr.

## ADIABATIC FLAME TEMPERATURE & COMBUSTION CALCULATIONS

CLIENT	COE		0	ATE	14-Jun-90
PLANT -	RAAP		1	IWĖ	01:08 PM
FUEL ULTIMATE	ANALYSIS	UDA EIIEI	DRY &	ADJUSTED	
CONSTITUENT	WT.PCT.			FUEL	
CARBON HYDROGEN DXYGEN NITROGEN SULFUR CHLORINE WATER INERTS	12.48 1.83 0.01 0.01 0.10 0.00 85.56 0.00	86.40 12.70 0.10 0.10 0.70 0.00 0.00	86.40 12.70 0.10 0.10 0.70 0.00 0.00 0.00	12.70 0.10 0.10 0.70 0.00 0.00	
FUEL RATE (TO TOTAL AIR ASS FUEL HIGHER HHEAT LOSS DUE CARBON IN RESEXIT GAS TEMPAMBIENT DRY BHUMIDITY RATI BAROMETRIC PR RADIATION LOSUNACCOUNTABLE ENTHALPY AODE	IGNED (%) EATING VALU TO UNBURNE IDUE (%) ERATURE (DE ULB TEMP (D 0 (LBS H20/ ESSURE (IN. S (%) LOSS (%)	E (BTU/LB) D CARBON (%) g. F) eg.F) LB ORY AIR) Hg.)		28 115 1902 0.00 0.00 1000 80 0.0132 29.92 0.00 0.00	

#### ADIABATIC FLAME TEMPERATURE & COMBUSTION CALCULATIONS

Ü	IJ	I	Ρ	IJ	1	-0	IJ	ţ	۲	,	U	-	J	IJ	1	۲	U	1	-(	U	1	1	,	IJ	1.	-U	U	1	٢	U	1	-(	) (	j	ı	۲	U	1 -
* }	<del>X</del> X	<del>X</del> )	ŧ ¥	<del>XX</del>	€¥	<del>XX</del>	<del>X</del> X	<del>X</del> X	XX	X	* *	XX:	* *	X)	ŧ ¥	XX	ХX	*	<del>(</del> <del>),</del>	XX	XX	*	* X	XX	X	ŧχ	<del>X</del> X	ΧX	**	* *	XX	XX	*	<del>(</del> X	X X	ХX	*×	ŧ¥¥

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP ·	TIME	01:08 PM

HEAT LOSSES	MMBTU/ḤR	PERCENT
IN DRY FLUE GAS FROM H20 IN AIR FROM H20 IN FUELSENSIBLE FROM H20 IN FUELLATENT	1.31 0.02 0.50 2.63	29.37 0.35 11.21 59.07
TOTAL IN WET FLUE GAS DUE TO UNBURNED CARBON DUE TO HOT ASH	4.45 0.00 0.00	100.00 0.00 0.00
DUE TO RADIATION & UNACCOUNTABLE	0.00 4.45	0.00

0.00
ERR
.0
3.41
42.47
2.38
13.712
5635

#### FLUE GAS ANALYSIS

	% BY VO	% BY WEIGHT				
	WET	DRY	WET	DRY		
CO2 SO2 O2 HCL N2	7.64 0.0232 1.65 0.0000 47.77	13.39 0.0406 2.39 0.0000 83.68	13.41 0.0592 2.11 0.0000 53.61	19.38 0.0856 3.04 0.0000 77.49		
H20	42.91	00.00	30.81	77.117		

#### FLUE GAS FLOWS

	WET.	DRY
MASS (LBS/HR)	7972	5516
VOLUME (ACFM)	5643	3222
(SCFM)(70DEG.F.)	2049	1169
ê 12% CO2	1305	1305
"F" FACTOR		
(DSCF/MMBTU @12% CO2)		17605

# ADIABATIC FLAME TEMPERATURE & COMBUSTION CALCULATIONS

		ū	ONDOSTION OF	ILOOLIII I OIIO	
**************************************	NPUT- I	NPUT- I	NPUT- I	NPUT-	INPUT-
CLIENT	COE		[	DATE	14-Jun-90
PLANT	RAAP			TIME	01:19 PM
FUEL ULTIMATE			257. 2	10 7110 750	
CONSTITUENT	WT.PCT.		ASH FREE		
CARBON HYDROGEN DXYGEN NITROGEN SULFUR CHLORINE WATER INERTS	1.83 0.01 0.01 0.10 0.00 85.56 0.00	86.40 12.70 0.10 0.10 0.70 0.00 0.00 0.00	12.70 0.10 0.10 0.70 0.00 0.00	12.70 0.10 0.10 0.70 0.00 0.00	
FUEL RATE (TO TOTAL AIR ASS FUEL HIGHER H HEAT LOSS DUE CARBON IN RES EXIT GAS TEMP AMBIENT DRY B HUMIDITY RATI BAROMETRIC PR RADIATION LOS	IGNED (%) EATING VALU TO UNBURNE IDUE (%) ERATURE (DE ULB TEMP (D O (LBS H2O/) ESSURE (IN.	D CARBON (%)  g. F)  eg.F)  LB DRY AIR)		28 300 1902 0.00 0:00 1000 80 0.0132 29.92 0.00	

UNACCOUNTABLE LOSS (%)

ENTHALPY ADDED IN BOILER (BTU/LB)

0.00

0

## ADIABATIC FLAME TEMPERATURE & COMBUSTION CALCULATIONS

CLIENT	COE	DATE	14-Jun-90
PLANT	RAAP	TIME	01:19 PM

HEAT LOSSES	MMBTU/HR	PERCENT
IN DRY FLUE GAS	3.41	76.62
FROM H2O IN A[R	0.04	0.90
FROM H20 IN FUELSENSIBLE	0.50	11.21
FROM H20 IN FUELLATENT	2.63	59.07
TOTAL IN WET FLUE GAS	6.57	147.80
DUE TO UNBURNED CARBON	0.00	0.00
DÜE TO HOT ASH	0.00	0.00
DUE TO RADIATION & UNACCOUNTABLE	0.00	0.00
TOTAL	6.57	147.80

BOILER EFFICIENCY (%)	-47.80
STEAM GENERATED (LBS/HR)	ERR
UNBURNED CARBON (LBS/HR)	0
LBS OF WET FLUE GAS PER LB FUEL	7.29
SPEC.VOL.OF WET FLUE GAS (CU.FT./LB)	39.60
AIR TO FUEL RATIO (LB AIR/LB FUEL)	6.21
COMB. AIR SPECIFIC VOL. (CU.FT/LB)	13.712
COMBUSTION AIR FLOW (LBS/HR)	14699

#### FLUE GAS ANALYSIS

	% BY VOLUME		% 8Y WE	IGHT
	WET	DRY	WET	DRY
CO2 SO2 O2	3.84 0.0116 11.05	4.95 0.0150 14.27	6.27 0.0277 13.14	7.39 0.0327 15.48
ACL N2 H20	0.0000 62.54 22.57	0.0000 80.76	0.0000 65.44 15.11	0.0000 77.09

#### FLUE GAS FLOWS .

	WET	ORY
MASS (LBS/HR)	17036	14462
VOLUME (ACFM)	11245	8707
(SCFM)(70DEG.F.) € 12% CO2	4082 13 <b>05</b>	3161 1305
'F' FACTOR (DSCF/MMBTU @12% CO2)		17605

0

<del>1</del>8 Radford Army Ammunition Plant Annual Heat Loss vs 02 in Incinerator Flue @ 1000 F  $\frac{1}{2}$ 10  $\omega$ 9 N 20 ភ 10 0 30 25 រ 45 40 35

Annual Heat loss (Mbtu) (Thousands) 02 In Dry Incinerator Flue Gas (%)

ECO#GP-X-4 INSTALL TURNING VAWES IN BOILER DUCTS PRESSURE DROP WITH EXISTING SQUARE CORNER ASSUME: 5280 FT/min, 300°F EXITGAS TEMP. ASPECT RATIO (YO) =1 FROM FIG 20 (ATTACHED) PRESSURE DROPIS O.B IN.W.C. PRESSURE DROP WITH 24" RADIUS BEND IN LIEW of SQUARE CORNER ASSUME 6'X6' DUCT. FROM FIG 20 AP = 0.28 IN. W.C. FAN ENERGY SAVED VOLUME = 6'x6' x 5280 FT/min = 190,000 ACFM ENERGY = (190,000) (0.8 - 0.28) X 746 = 16.56 KW ASSUME 50% LOAD FACTOR ON FAN 16,56 kw x 8760 Typ x . 5 = 72532 kwh/yr. 72532 Kwh/yr x 3413 Kwh X10-6 MET = 248 MBTWyn Typically 3 boilers operate in writer and zin assuming 2.5 boilers and 4 elbours per boiler gives 75 \* 4 \* 248 MBty/yr = 2480 MBTM/yr

RSH.

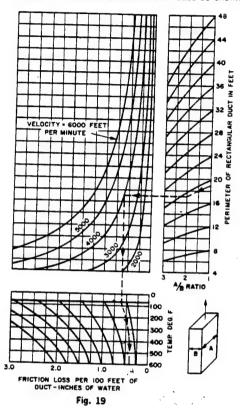
SUBJECT	•	AEP NO	
		SHEET	OF
DESIGNER	PFH	DATE	
CHECKER		DATE	

Derrent energy wie =

(190,000) (0.8) , 1116 x 3760 x 0.03026 = \$\frac{1}{2}\langle \frac{1}{2}\langle \frac

#### FRICTION LOSS IN RECTANGULAR DUCTS

All of the losses are figured for unlined steel ducts at 70 F and A/B  $\,$ ratio = 1. Correct for other temperatures and ratios as shown.



72

#### FRICTION LOSS IN PLAIN RECTANGULAR ELBOWS

All of the losses are figured for unlined steel elbows at 70 F and W/D ratio = 1. Correct for other temperatures and ratios as shown.

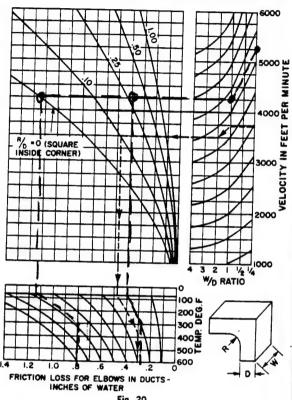


Fig. 20

73

24" RADIUS RENO MATIL COST ASSUME: 7 GAGE PLATE, 6 ST WIDE DUCT., 12/LASTEEL 24 /N X 121 X 21T X 6 ST = 18.85 St2/bend weight 7 gage pLATE weighs 7.5 LBS/ft2 18.85 Ft bend x 7.5 LRS FT2 = 141 LRS bend Cost STEEL PLATE COSTS ABOUT 12/LB FARRICATED \* MEANS, SPECIALTY STEEL 141 LBS/bond x #2/LB = \$282/bend.

CONSTRUCTION COST ESTIMATE			D		SHEET			
PROJECT					BASIS FO	OR ESTIN		OF
ENERGY ENGINEERING ANALYSIS						COOF 4	(No dans	gn completed)
RADFORD ARMY AMMUN	ITION	PLANT	•			-	reliminary	
ARCHITECT ENGINEER						CODE C	(Finel de	e(gn)
REYNOLDS, SMITH AND	D HILLS	A.E		NC.				
		ESTIM	6.	Fallon		CHECKE	Hut	cheis
ROUNDED DUCK	QUANT	ITY		LABOR	` 1	AIRSTAN		
ROUNDED DUCT SUMMARY	NO. UNITS	UNIT	PER	TOTAL	PER	TO:	TAL	COST
·	,							
BEND COST MATIL	,	ea			282	Ã	m 9	209
·LABOR Q9	3	-	341.32	1039	a o z	<i>*</i>	82	282
REMOVE EXICTING		W 173	7000	1007				1039
CORNER CREW Q9	•5	dove	346.32	172		0	ଚ୍ଚ	
	• 0	277	376.50				81	455
TOVAL				1212	1.		82	1494
LOCATION	<del></del>		.683	828	1.002		82	1110
SALES TAX			1.00	828	1.045		95	1/23
FICA	···		1.20	994	1.00	2	95	1289
OVERHEAD 15%								1482
PROFIT 10%								1631
BONO 1%				· · · · · · · · · · · · · · · · · · ·				1647
CONTINGENCY 10%								1812
Hercules 6%								1920
TOTAL PER A	L BOW					.•		1920
Five boilers & 4 elbow	5 Dec	h						X20
TOTAL CONSTRUC	TION	C04	1					\$38,400
				•				
						*		

REYNOLDS, SMITH AND HILLS RCHITECTS • ENGINEERS • PLANNERS BUBJECT RAAP EEAP T- Stat Control System

DESIGNER W. T. Toold

AEP NO 2900379000 6/12/90

ECO# GP-X-5

INSTALL THERMOSTAT CONTROL IN MOTOR HOUSES Assumptions:

- 1. Based on the Department of the Army Technical Manual a Freeze is possible for Roanoke, VA From October to May. This analysis assumes the radiators in the motor houses are left on for this period.
- 2. The main plant boiler efficiency is 76.600 15% distribution losses.
- 3. The average motor house dimensions are 7.5' by 7.5' by 7.5'.
- 4. The 99% winter design temperature is 9°F for Radford Ordnance Works (DA Technical Manual).
- 5. The design temperature for the motor house is assumed to be 60 °F.

## Current Energy Consumption:

Heat loss = 9 = U.A. DT

Outside air film (15mph)

Ashestos shingles (1/4", lapped)

R= 0.17 Hr-Seft. of

R= 0.21

R= 0.63

R = 0.68

A = Surface Area = (7.5ft x 7.5ft) /exposure x 5 exposures = 281 ft2

AT = Inside Temp - Outside Temp = 60°F-9°F = 51°F

# REYNOLDS, SMITH AND HILLS ARCHITECTS • ENGINEERS • PLANNERS INCORPORATED

SUBJECT	
T-stat (ontro) Sys.	SHEET OF
DESIGNER WIT Todd	DATE
CHECKER	DATE

### GP-X-5 Calculations (continued):

Since the radiators currently have no thermostat, the radiator output is assumed constant for all outside air temperatures.

$$Q = U \cdot A \cdot \Delta T$$
, existing energy consumption 
$$Q = 0.59 \frac{B + u}{hr \cdot Ft^2 \cdot o_F} * 281 Ft^2 * 51 o_F = 8455 B t n/hr$$

With thermostatic control, the motor house can be maintained at 40°F to prevent freezing. The on/off control value will reduce the radiator operating times.

Current operating time = 8 mo × 30 day × 24 hr = 5760 hrs

New operating time = 1833 hours {Dept. of Army? (hours temp. is at or below 40 ° F) {Tech. Manual}

Steam Savings =  $8455 \frac{Etn}{hr} * (5760-1833) hrs/yr * 105 buildings$ Steam Savings =  $33.2 \frac{mBtn}{yr} \times 105 = 3486 \frac{mRtn}{yr}$ 

REYNOLDS	•	SMITH	18	D	HILLS
ARCHITECTS	•	ENGINEER	ls ·	PL	ANNERS
	Iħ	CORPORATE	D		

WRIEGT T-Stat	Control System	AEP NO
		SHEET 3 OF
DESIGNER W.	T. Todd	DATE
HECKER		DATE

GP-X-5 Calculations (continued):

Net cost sourings = \$7409-3869 = \$3540/yr

Construction lost:

Project Cost = \$40,273

See construction cost estimate sheet for details.

Simple Payback

Payback = Cost + Annual Savings = \$40,273 = 3540 \$/yr = 11,4 years

CONSTRUCTION COST	ESTIMAT	E		Sept. 19	, 190	O SHEET	4 of
PROJECT ENERGY ENGINEERING	ANALYS	I S					
RADFORD ARMY AMMUNITION PLANT				CODE & (No design completed)			
ARCHITECT ENGINEER REYNOLDS, SMITH ANI						CODE C (Final decity)	11 gr.)
DRAWING NO.		ESTIM	ATOR	T. Todd		CHECKED BY	
	QUANTI	TY		LABOR		ATERIAL	
T-Stat Control SUMMARY	NO. UNITS	UNIT MEAS.	PER	TOTAL	PER	TOTAL	COST
Steam Valve - 2 Position		Ea	15	15.00	125	125.00	140.00
Thermostat - J.C. #T-26	1	Ea	25	25.00	50	50.00	75.00
Power Connection	1	Ea	25	25,00	20	20.00	45.00
Subtotal				65.00		195.00	260.00
			0.683		1.002	0.39	
Location Adjustments		•	0.603	(20.61)	4.5%		(20.22)
Sales Tax				0.00	4.2 %	0.79	8.79
FICA/Insurance			20%	8.88			8.88
Sub total							257.45
Overhead	15%						38.62
Profit	10%						29.61
Performance Bond	1%						3.26
RAAP Support	6%						19.74
Contingency	10%						34.86
, v							
Construction Cost	Ceac	h k	puild	ing)		•	# 383.55
Construction Cost (	E . 1	05	build				\$ 40,272,75
CONSTRUCTION ( DIST. )	701	03	Dalla	(ngs)			10,212,13
							·
		,					·
Vendor Quote For M	ateria	1 0	osts	- Johnson	Con	trols	
Labor Costs From M	eans	Me	chani	cal Cost	Data		
	1		I				[



### **Telephone Call Confirmation**

	·		Project No.	290-0319-0	100
	733-1411 L.D.				9-19-90
	Bill Todd	Conversed	WithSan	Pruitt	
Of _	Johnson Controls	Regard	ding T-stat	Control - R.	adford AAP
				,	
	Radiators c	an be cont	rolled wi	th a therm	ostat
	and a steam				
	model #T-26				
	does not ma				
	but many otl				
	from \$100 to				
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Distri	bution:				

REYNOLDS.	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS · PL	ANNERS
41	CORPORATI	ED	

DESIGNER W Tab

SUBJECT

SHEET \_\_\_\_\_OF

	Name	TOR HOUSES Area	_	100 Ft <sup>2</sup> Number	Page #'s
	Motor House	NC-A	48	2	9
	Motor House	A-Green	47	1 .	10
_	Elevator Mtr. Hse.	Sol. Rec.	56	63	11-16
_	Elevator Mtr Hse.	A-Finish	56	5	16-17
	Motor House	NC-B	48	1	19
	Motor House	B-Green	47	1	20
	Motor House	NC-C	48		21
9_	Motor House	C-Green	47		22
	Elevator Mtr. Hse.	C-Finish	36	3	24
_	Elevator Mtr. Hse.	C-Green	56	2	24
:	Motor House	Premix-1	96	2	30
	Motor House	Double Base	78		30
<u></u>	Elev. Mtv. Hse.	Double Base	56		30
	Elevator Mtr. Hse.	Sol. Rec.	56	12	30-31
i.	Motor House	A-Finish	55	4	34-35
	Motor House	Premix 1	54,78,53	3	36
( Constant	Motor House	RP-4	99		45

TOTAL 105

RSOL	

SUBJECT		AEP NO		
		SHEET	OF	
DESIGNER	G. FALLON	DATE	0/14/90	
CHECKER	P. HUTCHING	DATE	6/14/90	

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a spractices is symbolic and

FLO # GP - X-6 GANGE INCINERATOR FURL TO NAT. GAS INCINERATOR FUEL COST SAVINGS

FUEL OIL SAVINGS = 86,217 MBPL/yr

NAT GAS INCREASE = 86,217 MATE / YE

Current energy costs = #368,148/gv.

New energy costs:

86,217 + 3,36 = # 289,689 / yr.

Davings = \$ 78,458/yr.

CONSTRUCTION COST ESTIMATE					SHEET	OF		
ENERGY ENGINEEDING	ENERGY ENGINEERING ANALYSIS					BASIS FOR ESTIMATE		
RADFORD ARMY AMMUNITION PLANT					CODE A (No design completed)  CODE & (Proliminary design)			
ARCHITECT ENGINEER						CODE C (Final design)		
REYNOLDS, SMITH AND	HILLS	A.E.		NC.	CHECKED BY			
ECO # GP-1-6		E311m		LLON			PFH	
INCIN, NAT. GAS SUMMARY	QUANT	TY	PER	LABOR	PER	MATERIA		TOTAL
LINE	UNITS	MEAS.	UNIT	TOTAL	UNIT	70	TAL	COST
								·
							·	
					-			
		,						·
	<u> </u>							
				, ,				
Hercules Estimate								166,000
Hereocky Estimate								100,00
SUBTOTAL COST								166,000
OVERHEAD 15%								191,000
PROFIT 10%								210,000
BONO 1%								212,000
CONTINGENCY 5%								222,000
SIOH 6%								236,000
DESIGN FEES 10%								250,000
						-		0.0
TOTAL								250,000

Project No. 290 - 0379 -000
Local L.D Placed Rec'd Date Date
G. F. Conversed With Pat ZEEK
Of Radford (US. GAVM'T) Regarding Las line for incinerator
Incinerator Sax line - Past study citation.
Date of Study - 37 186
Dato of Study - 77 '86  Scope of work - 1e: Incinerator Burners new? NO  Total installed cost - \$142,960 +
Total installed cost - \$142,960 +
Ann Enern Sarina ? - NO.
How Much - 0
"Put a Pari" contract Muits Law Company
"Put or Pay" Contract With Sas Company is uncles negatiation and proceeding slowly.
alaula
· · · · · · · · · · · · · · · · · · ·
Original # 87-130,000/yr. savings
200-200 inthe led cont
200-250k installed cost.
Bosonie of level ail and material constraint
Because of fuel oil and natural gas price fluctuation Radford projects or 25-30% Cost saving to senith to natural gas.
gruendons rangord progress as 20 000
con saving to seems no marine gas.
Distribution:

REYNOLDS,	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS • PL	ANNERS
17	CORPORATI	ED	

SUBJECT	RAAP	EEAP	
Shut	off Pr	eheat Coils	
DESIGNER	W.T.	Todd	

AK

AEP NO 290-0379-000

SHEET | OF DATE 6-8-90

CO#MF-X-1

AUTOMATIC SHUT-OFF OF PRE-HEAT COIL AT FA.D.'S

### Assumptions:

- 1. The outside air opening is 3'x 3' and the flow rate is 11,000 ft3/min for each side of the FAD buildings.
- 2. The steam pre-heat coil is made from iron pipe that an inside diameter of I Inch and an outside diameter of 11/4 inches, and is 30 feet in length.
- 3. 40 lb. Steam is supplied to the pre-heat coils from October through May. They are currently controlled manually.
- 4. There are 4005 hours during October May when the temperature is greater than or equal to 40°F. Department of the Army Technical Manual, Engineering Weather Data, pages 3-398 & 3-399.
- 5. Temperature in the FAD's is controlled about 50 % of the time.
- 6. Assume the coils will only operate when the outside air temperature is below 40°F, and the average temperature during these months is 49°F, Statistical Abstract of the U.S., 1987.

Calculations:

Evaluate properties at Tm = (Tripe + To)/2

From steam tables @ 40 psig: Tpipe = 287°F

Tm = (287°F + 49°F) /2 = 168°F

REYNOLDS		SMITH	Α	ND	HILLS
ARCHITECTS	•	ENGINEE	RS	· PI	ANNERS
	11	CORPORAT	ED		

SUBJECT	AEP NO
Shut off Prohoat Coils	SHEETOF
DESIGNER W. Todd	DATE
1/1/	DATE

## Calculations (Continued):

When FAD is not operating-heat transfer from preheat coil occurs due to natural convection  $(h_{nc})$  and radiation  $(h_r)$ .

ht = hnc + hr

hnc = (Nnu \* k)/Lc

Lc= D = 0.104 Ft

Nnu = C (Ngr Npr)

Ngr = Lc3\*p2\*B\*AT\*g/u2

 $N_{pr} = C_p \times u / k = 0.72$ 

U = 1.390 EE-5 16/Ft. sec

p = 0.064 1b/ft3

B = 1.61 EE -3 1/0F

9BPZ = 1.14 EE 6 1/Ft3.0F

PE Review Manual 7 Appendix 3.4

Ngr = (0.104ft) \* 238°F \* 1.14 EE 6 \frac{1}{Ft^3.0F} = 3.05 EE 5

Ngr Npr = 3.05 EE 5 \* 0.72 = 2.20 EE 5

C = 0.53 , n = 0.25

Table 3.7, pg 3-17 PE Review Manual

#### REYNOLDS, SMITH AND HILLS ARCHITECTS · ENGINEERS · PLANNERS INCORPORATED

SUBJECT		AEP NO
Shut-off	= Preheat Coils	SHEET 3 OF
DESIGNER	W. T. Todd	DATE
		DATE

## Calculations (continued):

$$N_{nu} = \frac{h_{nc}L_{c}}{k} = C\left(N_{gr}N_{pr}\right)^{n} = 0.53(2.20 \text{ EE}5)^{0.25} = 11.37$$

$$h_{nc} = 11.37 * k/L_{c} = \frac{11.37 * 0.0168 \frac{Btu}{hr.ft.of}}{0.104 \text{ ft}} = 1.84 \frac{Btu}{hr.ft.of}$$

$$h_{r} = \frac{F_{c}F_{a}\sigma\left(T_{p}^{4} - T_{u}^{4}\right)}{T_{p} - T_{a}}$$

Tp = Temperature of pipe ≈ 287°F = 747°R

Tw = Temperature of wall ≈ 49°F = 509°R

Ta = Ampiant air temp. = 49°F = 509°R

σ = S-8 constant = 0.1713 EE-8 Btm/nr. Ft. OR4

Ep = emissivity of pipe = 0.64 oxidized castivon at 168°F Appendix 3.5, pg 3-30

Fe = Ep (For enclosed body, Aw>>Ap) = 0.64 Table 3.11

Fa = Shape Factor = 1 (for surrounded radiator) Page 3-24

hr = 0.64 \* 1 \* 0.1713 EE - 8 Btu (7470R)4-(5090R)4]
(287-49)0F

hr = 267.8 Btu/hr.ft2 = 1.13 Btu/hr.ft2.0F

ht = hnc thr = 1,84 + 1.13 = 2.97 Btu/hr.ft2. of

REYNOLDS.	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS · PL	ANNERS
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SUBJECT	off Prehecut Coils	AEP NO
Jhut	UIT FRENERIT COILS	SHEET
DESIGNER	W.T. Todd	DATE
<del></del>		

	- 1
SHEET	4 of
DATE	

### MF-X-1 Calculations (continued):

$$\Delta T = 287 \, ^{\circ}F - 49 \, ^{\circ}F = 228 \, ^{\circ}F$$

### Steam Savings:

### Coal Savings:

### Elec Price Diff Costs

# Net COST SAVINGS

$$\# Savings = \# 706 - 204 = \# 502/yr$$

REYNOLDS.	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS · PL	ANNERS
115	CORPORAT	ED	

SUBJECT	AEP NO
Shut Off Preheat Coils	CHEET 5 OF
	SHEETOF
DESIGNER W. Tout Todd	DATE
WH.	
CHECKER	DATE

MF-X-1 Calculations (Continued):

Project Cost:

Construction Cost = \$60,871

See Cost Estimate Sht.

Simple Payback:

Payback = Cost + Forings

= \$60,871 = \$502/yr = 121.2 years

	CONSTRUCTION COST ESTIMATE				<u> </u>	90 SHEET	6 25		
	PROJECT			6-11-90 SHEET 6 OF					
	ENERGY ENGINEERING ANALYSIS						CODE A (No design completed)		
	RADFORD ARMY AMMUNITION PLANT						CODE 5 (Preliminary design)		
	ARCHITECT ENGINEER		۸ ۲	0 1			CODE C (Final design)		
	REYNOLDS, SMITH AND	) HILLS	A.E.		NC.		CHECKED BY		
	NA			W.	T. Todd			1	
-	S/o Freheat Coils SUMMARY	QUANTI	TY	PER	LABOR		MATERIAL	TOTAL	
	30*************************************	UNITS	MEAS.	UNIT	TOTAL	UNIT	TOTAL	COST	
	O.A. Temperature Sensor	1	Ea	25	25.00	90	90.00	115.00	
	Modulating Setpoint								
	Compination Valve, 1"	1	EA	100	100.00	590	590,00	690.00	
	Misc. Mechanical			25	25.00	25	25.00	50.00	
	Misc, Electrical			25	25.00	25	25,00	50.00	
							.~		
	Subtotal				175.00		730.00	905.00	
	Sales Tax					4.5%		32,85	
Ì	FICA/Insurance			20%	35.00			35.00	
1									
	Subtotal				210.00		762.85	972.85	
٩	Overhead	15%						145.93	
I	Profit	10%						111.88	
ı	Performance Bond	1070						12.31	
I	Hercules Support	670					•	74.58	
I	Contingency	10 070						131.76	
I					·				
	Subtotal							1449.31	
	× 2 systems per	buil	din	a x 2	1 buildin	a, s		× 42	
						/			
	Construction Cost							\$60,871	
I				•			-		
I									
	Modified vendor a	note	0-	20	(4) Dm 4. +		t only h		
ļ	Johnson			5	Tacksonvill.	CI	904/7	33-1411	
I	-21/1/2011	UN		-,	CCC30NVIII.	-, -1	104/1/	22 1411	
1									

	722/120 854		F	roject No	290	0379 00	0
Local	703/639-8549	Placed		Poo'd		Date 6 -	8-90
Local							
	B. Todd					•	
Of	RAAP Maintenance	F	Regarding_	FAD F	teating	1 Systen	1_5
	FAD						
•	Bay,	Bay 3	1 3-15	1: 10-20	DOF DO	eumatic te	·
•	~	7 4	1	, <u>, , , , , , , , , , , , , , , , , , </u>	. 3 200	enmarke Ca	- Pr sentav
		<del></del>	/				
	Bay, E	4					
		12					
		<del>                                      </del>	averag	ive elev	nent		
	steam coil of	7	steam val				
	preheat coil -> [					led in "some	"blogs.)
******	preheat 21 ->		•	<u> </u>			
-	Ø. A						
	Mr. Childers has t	re most	t knowle	edge of	t the	FAD	
	buildings - this	is the	e Seco	nd wee	k of	his 3 we	eels
	vacation.						
	· acation.						
			,				<del> </del>
_9	1-19-90 Called Ste	ve Debus	sk / Juni	or Child	lers		
							· · · · · · · · · · · · · · · · · · ·
	Active FAD's ope	ivate c	approxim	nately	70 to	80 hour	<b>/</b> S
	per week. The		•	•			
	•		•			Che ccm	γ
	is maintained	during	These	Nours	•		
Distrib	oution:						

### **Telephone Call Confirmation**

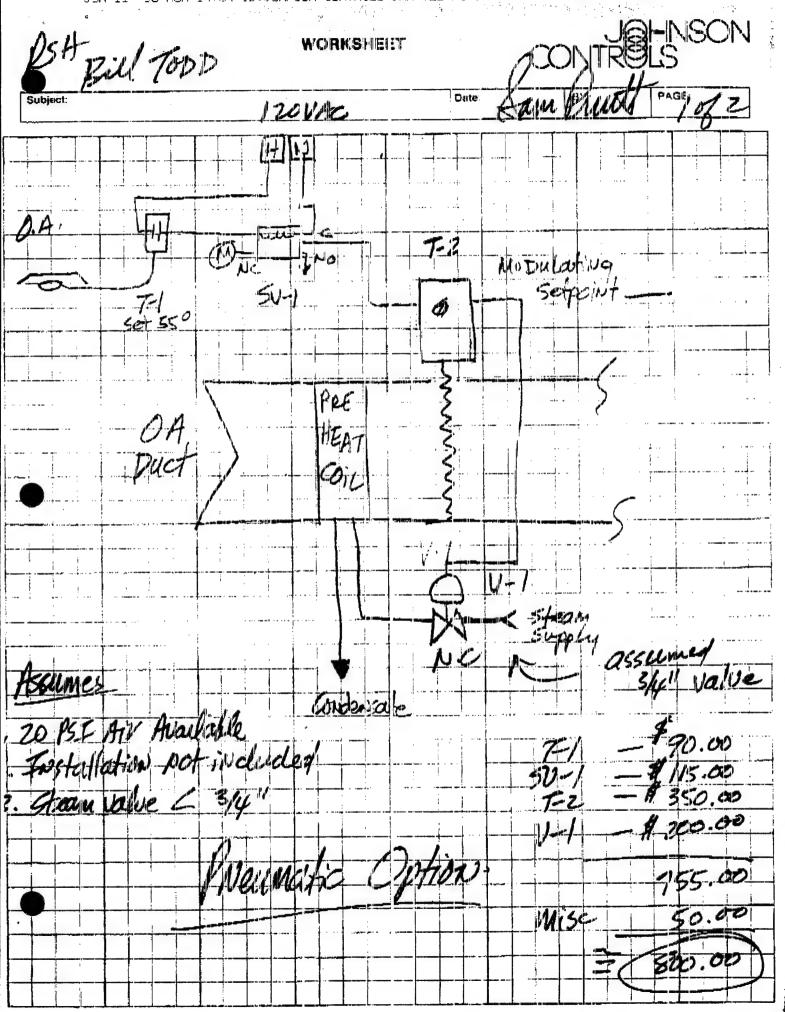
Pro	ject No. <u> </u>
Local 733-1411 L.D. Placed R	ec'd Date <u>6-11-90</u>
B. Todd Conversed With_	
Of Johnson Controls Regarding	
	·
Pre-heat pipes can be controlle	d either with
preumatic or electric controls	
2-way modulating value and	
air thermostat.	a postición occopia
of the state of th	
Sam will prepare a prelimin	an obside destale and
estimate, and FAX them to	ary design species and
estimate, and The Even be	me coday.
	***
	<del></del>
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•	
Distribution:	

CONTRILS
8245 Bayberry Road
Jacksonville, FL 32256

PIX # (904) 733-3335

TO:	RS.H.	DATE: 6-11-90	
ATTN:	Bill TODD		
CONFI	RMATION #  ROF PAGES (INCLUDING COVER)		
MESSAC	FE REMARKS:		
	The attacked an	e stetcher and prices	<b>5</b>
Fo	n platerial only	File 2 ways to can	to?
Di	schange Temp wife	Method puis the	
Con	ntral with and AD	itestable seferent.	
L PY	SENT BY: KIM MULT		

NULD KOU HAVE AMY PROBLEMS RECEIVING THE MESSAGE, PIERSE CONTACT : AT (904) 733-1411.



REYNOLDS.	SMITH	AND	HILLS		
ARCHITECTS .	ENGINEE	RS · PL	ANNERS		
INCORPORATED					

SUBJECT	Insulate	Boiling Tubs	AEP NO 29	00379	000
3003201			SHEET		
DESIGNER	9FH	,			
CHECKER			DATE		

### ECO # NC - W-1

## 1. Calculate tub heat loss

Calculate tub surface area

$$top = Tro^2/4 = 254 sf$$
  
bottom = " = 254 sf  
sides = Trott = 679 sf

Calculate heat transfer coefficients

① steel (225") = 
$$\frac{1.35}{2}$$
 =  $\frac{1.35}{1.35}$ 

W= 1/ ER = 0.741

w/o insulation

00	3 9	
1/11		

U = /ER = 0,10

REYNOLDS,	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS • PL	ANNERS
41	CORPORATI	ED	

SUBJECT	AEP NO
<b>A</b> 12	sheet 2 of
DESIGNER	
DESIGNER	DATE
CHECKED	DATE

w/o insulation

W/ insulation

4 film

0.61

# 2. Calculate total heat loss without insulation

$$Q = UAAT = (0.74)(679)(150) + (0.91)(254)(150) + (0.37)(254)(150) =$$

3. Calculate heat loss with insulation on top and sides

$$Q = LAAT (0.10)(679)(150) + (0.09)(254)(150) + (0.31)(254)(150)$$

REYNOLDS,	SMITH	AND	HILLS
ARCHITECTS	ENGINEE	RS · PL	ANNERS
I	NCORPORAT	ED	

SUBJECT	AEP NO
	SHEETOF
DESIGNER	DATE
	DAME

NC-4-1

1. Lateulate total annual savings Turidate five boiling tubs and three poachers

8. Calculate Electricity Price Differential Coda

### Cost Estimate

1NSULATION COSTS (1989 Means Mech. p 171)

\$ 6.42/ft 2 mat \$ 0.42

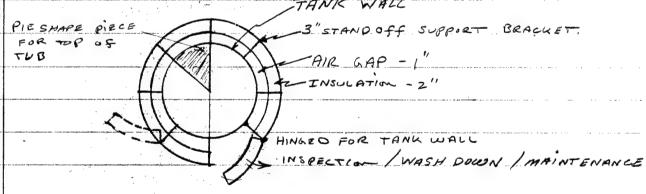
1.11 /ft 2 labor \* 0.68 adj = 0.75

\$ 1.57/ft 2 total \$ 1.17 \*933sf= 1092

NOTE: FOR SAFETY REASONS INSULATION MAY NOT BE

APPLIED DIRECTLY TO THE TANK WALL. A SINCH

STAND OFF SUPPORT FRAME SHOULD BE USED



RUBBERLIP SEAL TO PREVENT
CHIMNEY EFFECT.

AIR GAP

LEAVE GARE THE WOOD SUPPORTS

#### RE-PIPING COSTS

ASSUME: SCH40, 316 SS, WELDED, 4" \$, 24 EQUIN.,

\$45/1F (MEANS Pg.75)

#36/LF mat

1 15 /LF total # 0.68 (adj.) = 6 let

#### INSULATION SUPPORT BRACKET

ASSUME: 96 ft 3'x3" STAINLESS 4 43,75 LF

ASSUME: I WEEK INSTALLATION, @ \$35.00/MHR,

35 x 2x40 = \$2800 labor

96 x 3.75 = 360 materials

toTAL 3160

lab mut INSTALLED COST # 1092 700 392. Re Riping 1008 144 864 \$ 5260 364H 1614 SUPPORT BRACKET

CONSTRUCTION COST	ESTIMA	TE	-	DATE PREPARED	90	SHEET	OF	
ENERGY ENGINEERING ANALYSIS						OR ESTIMATE	n completed	
RADFORD ARMY AMMUNITION PLANT						CODE & (No design completed)  CODE & (Preliminary design)		
ARCHITECT ENGINEER REYNOLDS, SMITH AND	HILLS	A.E.	P., I	NC.	_	CODE C (Final de		
DRAWING NO. ECO#IC-U-1	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	ESTIM	ATOR	FH		CHECKED BY		
	QUANT	ITY	1	LABOR		MATERIAL		
Boiling Tub IRS. SUMMARY	NO. UNITS	UNIT	PER	TOTAL	PER-	TOTAL	COST	
Re-piping				144		864	1608	
Insulction				700		<b>592</b>	1092	
Re-piping Insulation Brackets				2800.		360	3160	
			•					
subtotals				3644		1616	5260	
	·						12	
sale tax (4.5%)						73	13	
FICA/Ins (20,0%)		-		729			129	
- 11 10				11272		1,09	1067	
Subtotale			at .	4372		1689	6062	
overhead (15%)							909 697	
Prof d (10%)							71	
Bond (190) Contingency (7.5%)							581	
Contingency (7.5%)								
							# 8326	
5 Boiling Tubs								
5 Boiling Tubs 3 Poachers							*8	
·				•				
							#66,608	
		-		7				
		-						
		-						
			!			<u> </u>		

RSH	
	D

SUBJECT	AEP NO
	SHEETOF
DESIGNER	DATE 9-24-90
CHECKER YH	DATE

ECO # NC -X - 1 THETHE BOILING THE HEAT EXCHANGER

Hercules date shows hailing tubes consume 1403 LBS /17C of 40 STEAM for a tub on hail. HEAT CONSUMPTION

HEAT CONSUMPTION

1408 LBS/HR/TUB XIIX BTY/B = 1.654 mBTU/HR/TUB

10 = BT/MOTU

OTHER DATA CHOWS A TUBIC ON BOIL FOR ABOUT 75% OF ITS CYCLE

ANNUAL HEAT CONSUMED

1.654 MBTIL/HR/TUE X 8760 x .75=10,870 MBTIL/yearth

PERCENT HEAT SAVED BY CONDENSING STEAM

$$\frac{95 - \frac{h_{fa}}{h_{f}}}{\frac{919}{1175}} \times 100 = 78.7\%$$

ANNUAL HEAT SAVED @ TUBS

10,870 MBTU/year/TUB x . 752 = 8501 MBTU/yr/TUB

ANNUAL COAL SHIP



SUBJECT		AEP NO				
		SHEET 2 OF				
DESIGNER	GE	DATE				
CHECKER	SA	DATE				

NC-X-1

Electricity price differential costs:

\$1.11/mets 40#5TM. X 8501 MBTU = \$9436 /yr /TUB

RSH	

SUBJECT		AEP NO				
	4	SHEET	3 <b>_of</b> _			
DESIGNER	87	DATE	9125/9	٥		
CHECKER	XX	DATE				

CHICULATE # of tubs # used puch year 27.9 ×106 # NC/yr = 30,000 LBS NC/TUB CYCLE = 930 TUB CYCLES/41 930 TUB CY/gr X100 HR/cy = 10.6 TUBS & 11 TUBS.

assuming 85% AVAILABILITY

11 tobs = 12.7 = 12 Tubo,

RAAP COAL ENERGY SAVINGS

11,221 MBTy / TUB X 11 TUBS = 123,431 more conclyr 123,431 \* 1.61 = \$198,724/yr.

Electricity Price Differential Costs:

8501 MBHu \* #1.11/MBHH \* 11 tubs = #103,797

# 198.724-103,797 = # 94,927/yr

RSH.	
TEO II	)

SUBJECT		AEP NO			
		SHEETOF			
DESIGNER	GF.	DATE			
a11101111	QH .	DATE			

NC-X-L

SIMPLE PAYLACK

$$\frac{4_{1/5,993}}{94,927} = 1.2 \text{ yrs}$$

For ORIP:

= 
$$(11, 221 \text{ MPM } \pm^{\#}1.61) - \pm^{\#}9436 = \pm^{\#}8630$$

$$COST = #115,993/5 = = #3924$$

CONSTRUCTION COST	ESTIMAT	E		DATE PREPARED		SHEET	OF
ENERGY ENGINEERING ANALYSIS						R ESTIMATE	
RADFORD ARMY AMMUNITION PLANT						CODE A (No designory of the contract of the co	
ARCHITECT ENGINEER						CODE C (Final dec HER (Specify)	ilen).
REYNOLDS, SMITH AND	HILLS	A.E.		- 0.1		CHECKED BY	r
ECO# CENC-X-	-1		(	Stallon		Man 1	
PERC. LINE H/X SUMMARY	QUANT			LABOR		ATERIAL	TOTAL
ERC. LINE 11/A SUMMARY	NO. ETIMU	UNIT MEAS.	PER	TOTAL	UNIT	TOTAL	COST
HEAT EXCHANGER							
3" SS 150 LB FLANGE	4	ea	29.00	116	129,15	517	633
S\$ 150 LB 4X3 REOVE	2	ca	30,00	60	100.00	200	260
3" 5CH 80 316 PIPE	20	A	8.60	172	57,28	1145	1317
4" SCH 40 316 PIPE	20	p-	9,05	181	35.56	707	888
							·
Pump					ŀ		
mecit	1	ea	88	88	1500	1560	1648
ELEC (means pg 277)	1	ea	430	430	290	290	720
							·
INSULATION							
4" pipe - 2"THK	20	127	2.99	40	5.57	1(1	171
SUB TOTAL (ONE TUR)				1107		45-30	5637
5 7085	حی		1107	5535	4530	22650	28185
LOCATION FACTOR			. 683	3780	1.002	22695	26475
SALES TAX				3780	1,045	23716	27496
FICA INS			1.2	4536	1,00	23716	28252
OVER HEAD 15%							32490
PROFIT 10%				•	,		35739
BOND 1%							36096
CONTINGENCY 10°/0							39706
Hercules 6%							42088
DESIGN FEE 1006	- 20						44613
TOTAL							44613
13 Tubs	13/5						\$ 115,994
Source: 1989 N	EANS						

REYNOLDS, SMITH AND HILLS ARCHITECTS • ENGINEERS • PLANNERS

Remove Steam Coils

DESIGNER W.T. Todd

SHEET | OF DATE | 5/21/90

AEP NO 2900379000

ECO# SR-I-1

REMOVE STEAM COIL FROM A.C.S.R. DUCTWORK

#### Assumptions:

- 1. The 450 hp exhaust fan motors are oversized by 20%.
- 2. The total pressure on the Fan is 20 inches of water.
- 3. The efficiency of the Fan and drive assembly is 65 %.
- 4. The efficiency of the fan motor is 85%.
- 5. There are three steam coils with I row and 14 fins per inch. The pressure drop across each coil is 0.75 inches of water.
- 6. The exhaust system operates 24 hours per day, 260 days per year (6240 hrs/yr).

#### Current Energy Consumption:

Bhp = Motor hp = 1.2 = 450 hp = 1.2 = 375 Bhp

Annual energy use =  $329 \text{ kw} \times 6240 \frac{\text{hrs}}{\text{yr}} = \frac{2,052,960 \text{ kwh/yr}}{2,052,960 \text{ kwh/yr}} = \frac{2,052,960 \text{ kwh/yr}}{2,052,960 \text{ kwh}} \times 3.413 \frac{\text{NBtu}}{\text{mwh}} = \frac{7007 \text{ metu/yr}}{2,052,960 \text{ kwh}} = \frac{7007 \text{ metu/yr}}{2,052,960 \text{ kwh}} = \frac{462,123 \text{ fr}}{2,052,960 \text{$ 

REYNOLDS,	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS · PL	ANNERS
IP	NCORPORAT	ED	

SUBJECT	AEP NO
Remove Steam Coils	SHEET OF
DESIGNER W.T. Todd	DATE
HECKER	DATE

#### ECO Costs:

Cost for removing steam coils, replacing ductwork and adjusting fan drive = \$16,997

Refer to Construction Cost Estimate sheet for detailed itemization of costs.

#### Simple Payback =

a The good his

Eco Payback = Cost = Savings

Payback = \$16,997 = \$13,973 /yr = 1.2 Years

Comment of the first of the second of the se

REYNOLDS,	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS · PL	ANNERS
41	CORPORAT	ED	

Remove Steam Coils SHEET 2 OF

DESIGNER W.T. Todd DATE

CHECKER

### Additional Energy Consumption:

There is no additional energy consumption required by this ECO.

### Energy Savings:

The reduction in total pressure by removing the steam coils would be:

TPr = 0.75 in. H20 /coil ×3 coils = 2.25 in. H20

The reduction in fan horsepower required is:

$$HP_r = \frac{CFM * TP_r}{Fan. EFF. \times 6350} = \frac{77390 \times 2.25}{0.65 \times 6350} = 42 hp$$

Energy Savings = 2 bldgs × 37 kw × 6240 hr/yr = 461,760 Kwh/yr

Energy Savings = 461.76 mwh × 3413 MBu = 1576 MBulyr

Annual cost savings = 461,760 kwh × 0.03026 kwh = \$13,973/yr

	CONSTRUCTION COST	ESTIMA	ΓE		DATE PREPARED 5/21	190	SHEET	H OF
	ENERGY ENGINEERING ANALYSIS				BASIS FOR ESTIMATE			
1	OCATION				CODE & (No design completed)			
	RADFORD ARMY AMMUNITION PLANT CODE & (Proliminary design)  ARCHITECT ENGINEER							
	REYNOLDS, SMITH AND	D HILLS	-		VC.	0 0 7	HER (Specify)	
	DRAWING NO.		ESTIM	W.	T. Todd		CHECKED BY	+
	Remove Steam Coilsummary	QUANT	TY		LABOR	N	ATERIAL	TOTAL
	NEMOVE DE COM COLDSUMMARY	NO. UNITS	UNIT MEAS.	PER	TOTAL	PER	TOTAL	COST
	Duct Demolition, 72"	30	LF	2.70	81.00	-	<b>—</b> .	81.00
	Coil Removal, 500 1b ea	1.5	Ton	395	592.50	-	_	592.50
	Duct, 72" Stainless Steel	30	LF	31	930.00	63	1890.00	2820.00
	Duct insulationil =" 1816	565	SF	1.07	604.55	0.52	293.80	898.35
	Duct ins. Jacket, Gal. Steel	30	LF	22.95	688.50	28.52	855.60	1544.10
	Adjust fan, balance air	ļ	EA	15.0	150.00	25	25.00	175.00
	Sabtotal				3046.05		3064.40	
	Location Adjustments			0.683	(965.60)		6.13	(9:59.47)
	Sales Tax					4.5%	137-62	137.62
	FICA/Insurance			20%	416.09			416.09
1	Subtotal							5704.69
	Overhead	15%						855.70
ı	Profit	10%						656.04
	Performance Bond	170					- · · · · · · · · · · · · · · · · · · ·	72.16
	Contingency	10%					.•	728.86
	RAAP Support	610						481.05
	Construction Cost	(for		1 ./	<i>a</i> . \			8498.50
I	construction tost	[   0   1	ach	buil	aing !			04-10.50
I	Construction Cost	(for	tu	0 64	ildings)			\$16997.00
	0-1/3 6-000 0101/ 003				Mary's J			
١								
					·			
	Source:							
7	Means Mechanical Co	st D	ata	, 198	9, Bave	Costs		
				'				

#### **Telephone Call Confirmation**

	Project No
Loca	al
	Bill Todd Conversed With Everett Grubb / H. Hill
Of_	RAAP Maintenance Regarding Activated Carbon Sol. Recovery
	Mr. Grubb was not available so I spoke with an
	assistant about heat recovery potential.
	* Solvent condenser uses filtered water (not chilled water)
_	at 40 lbs pressure.
	* Steam coils are not used. The steam values
)—	to these coils have been shot off.
	·
	·
	· · · · · · · · · · · · · · · · · · ·
Diet	ribution:

REYNOLDS.	SMITH	AND	HILLS
ARCHITECTS .	ENGINEE	RS · PL	ANNERS
B	NCORPORAT	ED	

BUBJECT Remove Steam Coils	AEP NO
	SHEETOF
DESIGNER W. T.Todd	DATE
CHECKER	DATE

#### Cost Esturate BACKUP

Means Mech page

Coil removal 500 16 each

\$395/ton

12

Dact removal 72" wide

\$ 2.70 /LF

231

New Duct - S. Steel 72" round

nut= (35-31.5) x 32 + 35 = \$63.00 /LF

Lab= (15,4-13,45) x 32+15,40=\$31.00/LF

Duct insulation

274 v 1 = 2x3,14 x 3Ft x 30 Ft = 565 sq. Ft.

insulation jacket 74" Ø

gal steel

mat = (13.95-11.65) × 38 + 13.95 = \$28.52/LF

Lab = (13.45-11.95) ×38 × 13.45 = \$22.95/LF

Fan adjustment (air balance)

\$175 each

	SUBJECT	AEP NO
REYNOLDS, SMITH AND HILLS		SHEET
ARCHITECTS . ENGINEERS . PLANNERS	DESIGNER D. Tode.	DATE
INCORPORATED	CHECKER	DATE
	MOST ESTIMATE RACKUP	

AEP NO	
SHEETO	F
DATE	

Means Mech page

Coil removal

500 lb each \$395/ton

Dact removal 72" wide \$2.70/LF

New Duct - S. Steel 72" round

nut= (35-31.5) x 32 + 35 = 63.00 /LF

Lab= (15.4-13.45) x 32+15.40= \$31.00/LF

Duct insulation

2744 = 2×3.14 × 3Ft × 30Ft = 565 sq. Ft.

229

insulation jacket 74" Ø

gal steel

mat = (13.95-11.65) x 38 + 13.95 = \$28.52/LF

Lab = (13.45-11.95) ×38 × 13.45 = \$22.95/LF

256

Fan adjustment (air balance)

\$175 each

RSH	

SUBJECT		AEP NO	AEP NO		
		SHEET	OF		
DESIGNER	FAH	DATE/ /	12/90		
CHECKER		DATE			

## Low/lost, No/3est lakeulations

#### LCNC 1

1. Repair steam levies (assume all are valves)

labor materials # 1000

4 hours # 11,000 44 Istal hos 17.33 1/hr Nource 39/90 Means TOTAL COST = \$ 11,785 Tuing

2 19" hade to general from Desir 5 30 mm/y

of the to I RADINA THE

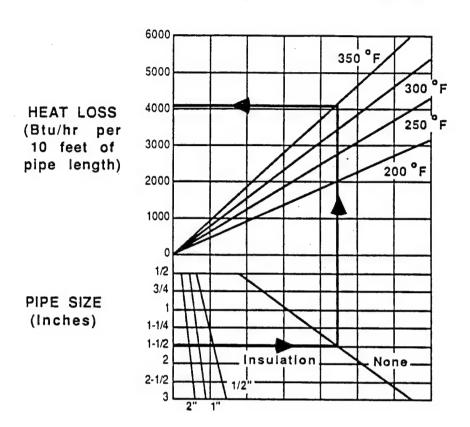
1.32 MRtu war for I MBtu stant. (App. 16 - Stan - to- Coal inversion factors)

500 x 1.32 \ 11 = 7260 mBilly / gk 7620 x \$1.01/WBTU = \$11,689 /yr.

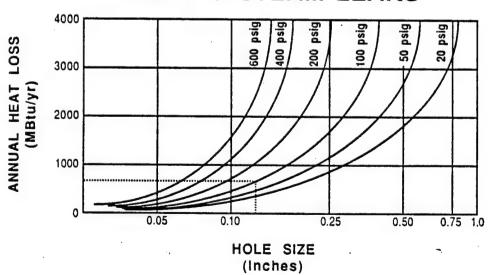
Elec. Price Diff COSTS

500 x 11 + \$1.11 = \$6105/yr. Net SAUINGS = #11,689-6105 = #5584/gr

#### PIPING HEAT LOSSES



#### CALCULATED HEAT LOSS DUE TO STEAM LEAKS



DCsI	4

SUBJECT	AEP NO	
	SHEET	OF
DESIGNER	DATE	
CHECKER	DATE	

LCNC=2 Turn off Unneeded Lights

Fenery Savings
20 instances x 10 lights (aug) x 60 watts

x 10 hrs/da \* 365 da/yr = 43,800 kwh

Jr

Cost saving = 43,800 \* \$0.03026

= \$\frac{1}{325}/yr.

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SUBJECT		AEP NO		
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DESIGNER	JA	DATE	12/90	
CHECKER		DATE		

LCNC 3 Repair Hoam Pipe Insulation

2" Labor Materials

Source 39/90 Means

brs # 0.25 446 # 4.75

Eight unstances @ 10 per

Tale

Manhous 0.55 + 10 + 18 = 45Idin #  $115 \times 17.85 = 4302$ Material  $1.75 \times 10 \times 18 = 4350$ 

total cost = # 1657

Eury Saving

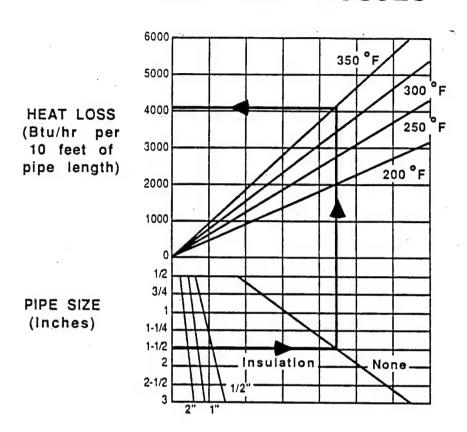
Not loss (per dayous)

ins addition, a person and to or 4000 Brothe

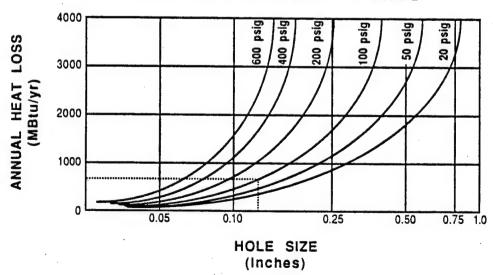
Elec. Price Diff. Costs = 5700 x 8760x8x 111=106= 238

Energy 2001 Awing = 342 × 1.61 = \$551/gr Net Saving = 551-238 = \$263/yr 3/91

#### PIPING HEAT LOSSES



#### CALCULATED HEAT LOSS DUE TO STEAM LEAKS



7)	Q.	

SUBJECT		AEP NO		
		SHEET	OF	
DESIGNER	- SA	DATE		
CHECKER		DATE		

LCNC 4 Turn of stram when not record.

a radiator user about 2000 Btu/hr (3f42, 4 column)

If used deening the non-hoafing season this uses

2000 Eth x 5 recordles x Ender x Eller x 1.32 = 9.5 M Bler/yr
hr Trem da stim
total

For your first

7 radiafores leach

7 radiafores leach

7 radiafores leach

Coal Savings = 9.5 x 21 = 200 in 13-th/yr (coal)

Coal Surings = 200 x 1.61 = #322/yr.

Elee. Price Diff Coats = 7.2 x 21 x #1.11 = #168/yr

Net Savings = \$322-\$168 = \$154/yr

Coal Savings = \$322-\$168 = \$154/yr

Coal Savings = \$322-\$168 = \$154/yr

Coal for turning off respectively rule.

1025 per table - 2016 = 180 ef

From MCHIE'S 100 Blu/hr/sf = 34.6 METM (ctm)

Energy Saving = 130 × 200 × I near x 3/1 x2/1/1 x 1.32 45.6 METM (soul)

Frank Cost

Saving = 46 × 1.61 = # 74/gr/fable × 4 table. = 296/gr = 134 MB.

Flec Price Deff Cost = 34.6 × 1.11 × 4 = \$154/gr Net Saving = \$142/gr

Totals = 384 MBtu/yr 3# 296/yr.

3/91

R	Se	H
		®

SUBJECT	AEP NO
	OF
DESIGNER	DATE
CHECKER	DATE

LCNC 5 Repair compressed in lacks

Savings

From astrue, a /3" hole wastes #932/yr

at 44/kwh

at 3.0264/kwh => #742/yr

142/3.0264 = 24,550 kwh

34 M514/yr

Cocks

Labor Materialia

Z hrs #50

\$\frac{2}{17.83/m}\$

35.66

Journe 39/90 Moons

TOTAL COST = \$ 66

## TYPICAL COSTS FOR STUCK OPEN STEAM TRAPS (1)

STEAM PRESSURE	= 100 PSIG	(342 F)		STEAM P	RESSURE =	200 PSIG
TRAP SIZE (INCHES) =>	1/8	3/16	1/4	1/8	3/16	1/4
STEAM ENERGY LOSS (MBTU/YR) ===>	500	1100	2100	1250	2200	4000
STEAM COST (\$/MBTU)						
\$3.00	\$1,000	\$2,200	\$4,200	\$2,500	\$4,400	\$8,000
\$3.58 (Note 2)	\$1,789	\$3,936	\$7,514	\$4,473	\$7,872	\$14,313
\$5.00	\$2,500	\$5,500	\$10,500	\$6,250	\$11,000	\$20,000

<sup>(1)</sup> BASED ON A STEAM ENERGY VALUE OF 1000 BTU/LB AND STEAM LEAKAGE RATES AS GIVEN IN THE BARRON'S MANUAL OF ENERGY SAVINGS IN EXISTING PLANTS.

## ANNUAL COST FOR TYPICAL COMPRESSED AIR LEAKS

SYSTEM PRESSURE	HOLE DIAMETER	CUBIC FEET OF COMPRESSED AIR WASTED PER YEAR	COST OF ENERGY WASTED \$/YEAR (1)
100 PSIG	3/8-inch	79,000,000	\$8,734
	1/8-inch	8,880,000	\$982
	1/32-inch	553,000	\$61
70 PSIG	3/8-inch	59,100,000	\$5,300
	1/8-inch	6,560,000	\$588
	1/32-inch	410,000	\$37

<sup>(1)</sup> BASED ON AN AVERAGE LOCAL ELECTRICITY COST OF 4.0¢/kWh INCLUDING DEMAND CHARGES.

<sup>(2)</sup> CALCULATED USING A NATURAL GAS COST OF \$2.29/MBTU AND ASSUMING A COMBUSTION EFFICIENCY OF 80% AND 20% DISTRIBUTION SYSTEM LOSSES.

# Telephone Gall reynolds, smith and hills

Project	No
	10.21/29 0707

Date 11/1/90  P. Statchin Conversed with John Parkins  Of Hereules (Radjord) Regarding Programming Doc's
- JP returned my call and gave instructions for
completing QRIP and OSD PIF forms
- He also said no forms need to be completed for
ECAM projects, as they would combine many
projects into a single annual submittal under
the Production Support and Equipment Replacement
program the would need a project write up and
lifecycle cost analysis with bade up calc's.
OKIP and OSD PIF F492 implementation date
FCAM PY95 "
Escalate construction costs at _ % per year
Escalate construction costs at % per year  1.09 92 1.1358 FY 92 Call litts for \$7 155 Eil  1.1264 93 1.1137 FY 93 Secuments Project administration 1.1965 95 1.2468 FY 95
Distribution:

## Telephone Gall Confirmation

Project No. 290 0379 -000 (309) 182-5743

reynolds, smith and hills

LocalL.D	Placed	_Recd	Date <u>8/3//5</u> =
P. HURHINS	Conversed with	Can Box	dtram
of Amccom	Regarding	Every Proj	ed funding
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G.B. indicated tha	* The follows	uj change	s u
project cost v			
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9121 1101	20 Cost Trange	"	
PECIP -		2 \$ 10	0,000
		•	
OSD PIF -		2 4 10	00,000 (DOD)
	,		
ECIP does not apple	ly for GOCOA	use Ect	ni instead.
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ECAM requires for	rm 1-13 (x	ee nr 100	70). 17
greater than \$ 200.	000 it requ	iver form	1391.
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Distribution:			A to the first product of

# Telephone Gall reynolds, smith and hills

Local  Of	P. Hutching	Placed ConversedRegard	Rec'd	fer Labor Rales
	TP said of the	e use \$17.83 Pipe Stop	the fer	labor rate